Exploring young people's collaborative and creative processes using keyboard and computer based music technologies in formal and non-formal settings

Thesis

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Exploring young people's collaborative and creative processes using keyboard and computer based music technologies in formal and non-formal settings

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Abstract

In many UK music education settings, young people (11-17 years old) make music collectively. Despite this we currently lack understanding of the processes involved when collaboratively creating music, particularly when working around music technologies. To date, research has tended to focus on classroom-based collaborative interactions on well-defined tasks, where there is only one correct solution. As a result we know little about 1) the kinds of learning practices that emerge outside of school settings and 2) the processes young people engage in when working on open-ended, creative tasks.

Addressing these areas, this research specifically set out to explore the nature of the creative process when composing music collaboratively using keyboards and sampling software, in school, community centre and music camp settings. The contextual relations or features of these different settings, such as the task setting, instruction and technology used and their influence on the creative music-making processes were examined. This was achieved through analysis of the young people's verbal dialogues, which resulted in greater understanding of the relations between context and creativity.

The findings show that how the creative and musical content is organised, rather than the physical setting within which it takes place, plays a fundamental role in the types of talk and creative processes that emerge.

Drawing on the results of the studies carried out, creativity was conceptualised as a cyclic process, with interdependent phases of

exploration, discovery, elaboration, critical listening, refining and editing, recording and saving; with problem finding and discovery being central underlying drivers.

Finally, the kinds of verbal dialogues that emerged across all the settings strongly indicated that traditional logical-deductive types of reasoning and talk are not necessary and may even be inappropriate for certain phases of the creative process. This finding is interesting and presents some challenges to our current understanding of collaborative learning. Consequently, it warrants further investigation.

In sum, given the contemporary educational emphasis on self-directed and creative learners, the questions addressed in this thesis and the findings on the context and nature of the creative processes, and informal and formal learning, are considered timely and relevant.

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1. Introduction

The work carried out in this thesis bridges three core areas: 1) music technology; 2) creative collaboration; and 3) research in formal and non-formal learning. This introduction briefly introduces each area and situates the work undertaken within contemporary educational debates and discourses on personalised learning and new media. Weaving these areas together, the main research questions addressed in this thesis and their potential significance and contribution to current debates are presented, along with an overview of the structure of the thesis.

Since the early 1980s, the availability and application of ICT across the curriculum has spread to influence all subject areas. However, it was not until the 1990s that music technologies were explicitly referred to in the National Curriculum for England and Wales, and today they are used widely, with music technology becoming a recognised subject area in its own right. Recent surveys carried out by the Office for Standards in Education (Ofsted) reflect a complex picture. For example, one survey on *Music in Secondary Schools* (2001/2003) reports that 'The use of music technology remains weak in Key Stage 3.' (p. 7) and in some schools was considered 'as an additional – even exotic – resource.' (p. 8), while another survey reports report that music technologies have had a 'positive impact on teaching and learning in music in the majority of secondary schools.' (Ofsted, 2004, p. 4). These contradictory comments reflect a complex situation.

What is clear is that, within the past five years, music technology has become recognised as a form of A-level study in its own right, which can lead to further study within specialist higher education departments, as well as to careers within a variety of industries.

However, despite the appropriation of technologies within the secondary school music curriculum, we know little about the creative process that such tools support or the kinds of learning environments necessary for their optimal use. To address this imbalance, this thesis focuses on exploring the contextual features, such as the task setting and instruction, the technology used, the influence of teachers instructions, wider cultural references (e.g. films, pop music), prior musical experience and formal music training on technologically enabled collaborative creative processes. These issues are examined on a case-by-case basis, across a variety of formal and non-formal settings.

In examining existing keyboard- and computer-based music practices, in collaborative formal and non-formal settings, this thesis addresses complex debates currently in education in the UK, the most prevalent of which focuses on how to nurture and support the development of creative, flexible and self-directed learners.

1.1 Relevance to contemporary educational discourse

Since beginning this research, it has been interesting to note how creativity and the formal/non-formal continuum of learning have become 'hot' topics in their own right. The government's current 'personalised learning' agenda in the UK aims to 'tailor education to each individual's needs, interests and aptitude'[1]. Central to this is the goal to support creative and innovative learning environments where pupils

[1] http://www.standards.dfes.gov.uk/personalisedlearning/about/

reach their goals and where teachers are flexible, adapting their style to pupils' needs. Part of this approach is to address what is considered as the home-school divide – that is, the division between learning that happens in the home and other informal spaces, and learning that happens in the school. The recently published *Personalisation and Digital Technologies* charter (Green et al., 2005) notes how digital technologies can play a central role in bridging this divide and supporting learners' different learning styles and paths. Loveless and others (Buckingham, 2000, 2003; Sefton-Green, 2000) also note that in our 'Knowledge Age' (Loveless, 2002, p. 2) - that is, the age of communication and digital technologies - we increasingly live in a networked world in which mobile telephony and locative, wireless media now allow us to traverse home, school and community environments in ways not previously possible. Sefton-Green (2003), in his review of the potential of digital technologies for non-formal learning, advocates that we need to understand and pay heed to existing and emerging digital practices and the forms of interactions, both real and virtual, that they support, as they could influence how we develop new learning curricula.

From my perspective, understanding the creative process and the kinds of environments within which digital tools are adopted and used collaboratively will allow for better understanding of how to create meaningful learning experiences and foster creative thinking in and outside school contexts. It is anticipated that, by exploring questions around the resources, skills and thinking processes called upon and engaged in by young people when creating content in different settings using music technologies, we will gain deeper insight into these issues.

1.2 Research questions and key contributions

To understand collaborative creative processes it is necessary to understand how young people interpret the various interpersonal, contextual features and social interactions within which they make music. This thesis has attempted to sketch these dynamic interactions across five key settings (two school settings, a community-centre setting, a Girls' Brigade band setting, and a summer music-camp setting). Through analysis of the young people's verbal dialogues, the influence of different contextual features on the young people's collaborative creative interactions was explored. Each of the core empirical studies (Chapters 7 to 12) addressed particular research questions, which altogether contributed to a more informed understanding of the key questions addressed in the thesis. These were:

1) What kinds of verbal dialogues do young people engage in when working around keyboards and eJay sampling software in formal and non-formal settings?
2) What are the collaborative creative processes young people engage in when making music together using keyboards and eJay software in formal and non-formal settings?
3) How do different aspects of the context (e.g. task setting and instruction; technology; teacher; prior musical and cultural experiences) influence the collaborative creative process?

In focusing on these three questions, this thesis contributes to our ongoing understanding of the collaborative creative processes around existing music technologies. In particular the thesis contributes to the field of music education, where there is a dearth of knowledge on the kinds of interactions such instruments support. In relation to the field of collaboration and creativity, the thesis brings together understandings from sociocultural perspectives on collaboration (Cole & Griffin, 1983, Cole, 1992; Luria, 1976; Rogoff, 1990; Vygotsky, 1978, 1988; Wertsch, 1985) and contemporary understandings of creativity (Amabile et al., 1996; Csikszentmihályi, 1997, 1990; John-Steiner, 2000; Loveless, 2002; Miell & Littleton, 2004; Sefton-Green, 2000). The combination of multiple theoretical and empirical perspectives was necessary, as these areas had previously not been brought together in such a way. This approach led to a greater understanding of the dialogical collaborative social interactions engaged in when making music using keyboards and music sampling software in different settings.

1.3 Structure of the thesis

Including the introduction, the thesis is organised into thirteen chapters, which are broken down as indicated in Sections 1.3.1 to 1.3.3:

1.3.1 Theoretical chapters

Chapters 2 to 5 offer a review of the existing theoretical and empirical work which informs the thesis. Chapter 2 presents the review methodology employed when carrying out the literature searches and review. Specifically, Chapter 2 focuses on the link between sociocultural theory, situated learning, cross-cultural, non-formal and formal learning research. Drawing on these perspectives, the chapter addresses how the context and the specific relations (e.g. the task instruction, the participants and the institutional and cultural climate) within a given setting influence the kinds of interactions that emerge. In doing so, this chapter provides the theoretical backdrop and conceptual framework within which this thesis was situated. It also provides the background literature on how context was understood within this thesis, and how the particular relations within a given setting influence the creative process.

The remaining theoretical chapters (Chapters 3 to 5) present the background information from which the remaining key research questions emerged. For example, in focusing on the kinds of verbal dialogues young people engaged in when working around keyboards and eJay sampling software, it was necessary to review the relevant literature on collaborative verbal dialogues. Chapter 3 presents this research from the perspective of sociocultural theory. The chapter concludes with a rationale for why an analysis of participant verbal dialogues can be seen as an appropriate methodology for research in this area.

In turn, Chapter 4 provides the background for addressing the second key research question in this thesis, the role of computers in collaborative learning and music education. The chapter explores how computers and digital technologies contribute uniquely to the learning process, concluding with an overview on the use of computers within music education.

Chapter 5 provides an overview on research within creativity, focusing in particular on social understandings of creativity and the creative thinking process in relation to music and technology.

Each of the theoretical chapters connects to the others, emphasising the need for research in this area and how, through an approach combining theoretical and methodological insights, we can develop an enhanced understanding of the collaborative creative process, and its nuances.

1.3.2 Research questions

Chapter 6 synthesises the core theoretical points from which the main research questions were derived, and the rationale for each of the following empirical chapters is summarised. To reiterate, the key questions addressed in this thesis were:

1. What kinds of verbal dialogues do young people engage in when working around keyboards and eJay sampling software in formal and non-formal settings?
2. What are the collaborative creative processes young people engage in when making music together using keyboards and eJay software in formal and non-formal settings?
3. How do different aspects of the context (e.g. task setting and instruction; technology; prior musical and cultural experiences) influence the collaborative creative process?

1.3.3 Empirical Chapters

Chapter 7 is the first of the empirical chapters and presents the findings from the technology survey of music teachers. This study provides a snapshot of music teachers' perceptions and experiences of using music technologies and their social context of use. The core findings of this survey informed the kinds of technologies (keyboards and eJay sampling software) that were examined in this thesis. Chapter 8 presents the methodological framework used to analyse the participants' verbal dialogue when making music together using keyboards and computers. The coding scheme was specifically designed to analyse the situations presented in this thesis.

Chapters 9 to 12 present the series of studies that were carried out, which explored how young people create meaning when working together in a variety of formal (school) and non-formal (community centre and music camp) settings. Each chapter examines how different aspects of the context - such as the task setting and instruction, type of technology used, teacher's influence, wider cultural references (e.g. films, pop music), prior musical experience and/or formal music training - influenced the young people's collaborative creative interactions and compositional processes.

- **Formal school setting**

Chapter 9 examines young people's creative, collaborative interactions when using keyboards in a semi-formal school setting. The results of the music teachers' survey indicated that keyboards were the most commonly used music technology within secondary schools. This chapter reports on the kinds of verbal dialogues that were found in this setting and the influence of the task instruction on the young people's music-making processes. Chapter 10 examines young people's interactions when making music using a sampling-based software called eJay in a typical classroom setting. As before, the rationale for focusing on eJay was due to the music survey findings, which indicated that eJay was popular in secondary school music-technology settings. The main contextual feature focused on, within this chapter, is how the eJay software influenced the kinds of verbal dialogues and creative processes the young people engaged in.

- **Nonformal settings**

Chapter 11 investigates young people's collaborative creative process when making music using eJay in a community-centre setting. The chapter focuses on the how the task setting and wider cultural references, such as television, pop culture and their prior musical experiences, influenced young people's creative collaborative processes. Continuing the theme of prior musical experiences, Chapter 12 concludes the empirical chapters by focusing on how young people's prior musical experiences and formal musical training influenced their collaborative creative processes when composing with eJay. The chapter draws on two case study settings - participants from a Girls' Brigade band practice session in a community centre and a summer music camp setting, where young people with formal instrumental training attended a fun week of mixed music activities.

1.4 Discussion, conclusion and next steps

Chapter 13 summaries the main findings from each of the empirical chapters and relates them to the main theoretical framework and contemporary learning debates. The overall outcomes of the thesis and how it has contributed to the fields of creativity, collaborative learning and music technology are discussed. Recommendations are made for how the study could be improved and future directions for research in this area are proposed.

2. A review of sociocultural theory

2.1 Introduction

The interest in understanding creative collaboration came initially from my background in arts and theatre. As a practising artist, I was interested in why some collaborations were more productive than others and in what kinds of environments or contexts creativity flourished. In researching this area I became interested in sociocultural theory (Gal'perin, 1969; Leont'ev, 1978; Vygotsky, 1978, 1988; Wertsch & Tulviste, 1998), which offered a framework through which to understand the underlying social processes and relationships that influence our thinking and decision making.

Within this chapter the relevant aspects of sociocultural theory and the main thinkers in this area, such as its 'godfather' the Russian psychologist Lev Vygotsky, and contemporary neo-Vygotskian work (Cole, 1991; Rogoff, 1990; Wertsch, 1985), are drawn on. Additionally, perspectives from the strand of sociocultural theory known as 'situated learning' (Lave, 1979, 1988, 2004; Lave & Wegner, 1991) are also discussed, as they assisted in better understanding the nuances of the different settings explored within this thesis. Finally, research from the field of cross-cultural education (Cole, 1992; Cole & Bruner, 1971; Cole & Griffin, 1987) and non-formal learning (Eraut, 2000; Marsick & Watkins, 1990; Sefton-Green, 2003; Smith & Jeffs, 1990) are also examined. These multiple and complementary perspectives provided a layered approach to examining the key research questions addressed in this thesis.

Underlying the aforementioned areas is the central belief that how we define and solve problems or tasks is fundamentally bound to the society and culture in which we operate in the micro context, in which the problems emerge. This perspective has been central to the notion of context and understandings of creativity within this research.

2.2 Approach to literature review

The literature review conducted for this thesis is presented in the current and following three chapters (Chapters 2 to 5). Each component of the literature review focused on addressing the key research questions addressed in this thesis. The current chapter, (Chapter 2) focused on grounding the research within sociocultural understandings of education. Chapter 2 also provided the backdrop from which a more informed understanding of context emerged; this understanding was necessary in order to address how the specific features of the settings examined influenced the creative collaborative process. The following theoretical chapters respectively focused on the role of verbal dialogue in collaboration (Chapter 3), the role of computers in collaborative learning and music (Chapter 4), and the creative process (Chapter 5).

Within each chapter the same approach was applied. The method followed, drew on Hart's (1971) guidelines for carrying out literature reviews. First, within each particular area, an electronic search was carried out using the key databases (i.e. the Educational Resources Information Centre, ERIC; the Social Sciences Citation Index; Social Sciences Information and Documentation Centre; SWIDOC; and the Psychological reference list, Psyclit). As there is a dearth of research carried out specifically on music technology-based creative collaborations, key words such as 'creativity'; 'collaboration'; 'creative process'; 'music technologies'; 'computer music'; 'computer supported collaborative learning'; 'collaborative dialogues' were first entered into the above databases. This yielded a variety of works. At the time of carrying out the research there were no articles found which actually combined 'creativity, collaboration and music technologies'. Based on this finding, it became clear that the outcomes of this thesis would at the very least provide a new contribution to the field. However, it was also apparent that the literature review should in the initial phase be as broad as possible so that the necessary topics could be understood. From this, a more refined understanding of the gaps and complementary understandings between each area emerged.

Reading the abstracts from the above literature search, it was clear that not all the literature produced using these search words was relevant. As the review process progressed, studies which did not complement the core sociocultural approach taken in this thesis were acknowledged but not included in this final presentation. Also, research that did not focus on young people, in particular those between the secondary schools ages of 13 to 17 years (the target age range addressed in this thesis), was also discounted. As the main interest was in composition, and in particular technologically mediated music composition processes, research that did not focus on this aspect was also excluded.

Second, continual searches of the World Wide Web (via Google) throughout the research period yielded further results. Relevant books, articles and conference papers were found, which supplemented the core database search. Third, throughout the process relevant journals were studied, while proceedings from conferences attended provided regular updates on developments within the field. Finally, practical experiences while working creatively as an artist and performer (from 1998 to date) contributed to the understandings, which emerged. In this respect, the work developed alongside practical experiences in the field as well as in consultation with colleagues, supervisors and experts who have reviewed or read the published and unpublished parts of this thesis.

2.3 Sociocultural theory: the inherent mutuality between people and their environments

Sociocultural theorists believe that cognition has its origins in social life (Gal'perin, 1969; Leont'ev, 1978; Vygotsky, 1978, 1988; Wertsch & Tulviste, 1998). From this perspective, development is a result of participation in social interactions and culturally organised activities with others. According to Rogoff et al. (1995) this understanding broke with traditional views of development (e.g. Skinner, 1958) which tended to consider the individual and their environment as separate entities.

Sociocultural theorists reformulated this relationship, emphasising the essential mutuality and inherent inseparability of individual and environment. As a result, the activity or the event and all its constituting social, cultural and historical relationships is considered as the basic unit of analysis.

One of the most important sociocultural theoreticians was the Russian, Lev Vygotsky (1896–1934), who with his collaborators (Luria and Leont'ev) began to formalise a sociocultural theory of development. Vygotsky considered cognitive development to be the transformation of socially shared activities into internalised individual processes, emphasising the mutually constitutive relationship between the individual and their environment. Central to this conceptualisation of human development was the intertwining of natural, biological processes, with the mastery and use of culturally mediated tools, in particular psychological (e.g. speech) and physical tools (e.g. pens, computers). Vygotsky insisted that higher mental functions (e.g. intelligence) were formed by a reorganisation of lower mental functions (e.g. attention, memory) mediated by cultural signs, which he called 'semiotic mediation'. Semiotic mediation referred to the mastery of different psychological and physical tools by the individual, which led to individuals reorganising and reconstructing their thinking (Section 2.3.1 will discuss mediation in greater detail).

Vygotsky's assumption was that human mental functioning could only be understood in terms of its development from more primitive forms. He made the distinction between what he called elementary mental functions (EMF) and the higher mental functions (HMF).

Vygotsky's central claim was that HMF emerged in the context of social, interpersonal interaction, and this belief gave rise to his general genetic law of cultural development, which stated:

> Any function in the child's cultural development appears twice, or on two planes. First it appears on the social plane, and then on the psychological plane. First it appears between people as an interpsychological category, and then within the child as an intrapsychological category ... Social relations or relations among people genetically underlie all higher functions and their relationships. (Vygotksy, 1981, p. 163)

In his ambitious genetic law of development Vygotsky tried to encapsulate the interdependence between biological and cultural lines of development. He firmly believed that development could *not* be understood without considering it on interrelated levels (Cole, 1991). The four levels he considered important were: the developmental or phylogenetic level; the sociocultural level; the historical or ontogenetic level; and the moment-to-moment, temporal or microgenetic level. Many researchers (Cole, 1991; Rogoff, 1990; Wertsch, 1985) have spent time trying to achieve methodologically Vygotsky's interrelated perspective.

For example, Rogoff (1995) also re-emphasised the importance of understanding the nature of development and the inherent mutuality between the individual, their cultural roots and social ties:

> ...it is incomplete to focus only on the relationship of individual development and social interaction without concern for the cultural activity in which personal and interpersonal actions take place. And it is incomplete to assume that development occurs in one plane and not in others (e.g. that children develop but that their partners or their cultural communities do not) or that influence can be ascribed in one direction or another or that relative contributions can be counted (e.g. parent to child, child to parent, culture to individual).(Rogoff, 1995, pp. 134-5)

Rogoff's (1995) re-orientation brought into focus aspects of learning which often tended to be overlooked, such as past and current power relationships between community members and how these relationships were embedded in the social institutions and environs within which they operated.

Additionally, Rogoff (1990, 1994) emphasised the need to focus on diverse cultural activities, within everyday contexts. According to Rogoff, in order to understand human activity the following planes need to be taken into account, as they are inseparable:

- *Personal* (individual cognition, emotion, values and beliefs)
- *Interpersonal* (communication, role, dialogue, conflict, assistance and assessment)
- *Community* (shared history, values, beliefs, identities, activities)

In an attempt to solve the methodological quagmire about how to analyse interrelated planes or levels, Rogoff proposed that one plane, or parts of a plane, could be studied and brought to the foreground in order to understand it better, without losing track of its inherent interdependence on the others. This understanding was pivotal and provided a means through which to study both Vygotksy's concept of levels and Rogoff's notion of planes. Complementing Rogoff's viewpoint, Cole and Griffin's (1987) work within classroom settings, where they researched what they called the *constitutional relations* (that is, the relations between participants, tools and the institutional setting), also calls for a multilayered approach to understanding learning. From their perspective, the task is the mediating variable between both the learner and the wider contextual relations, or planes as Rogoff would put it. They argue that it's the 'weaving together' (Cole & Griffin, 1987, p. 5) of such relations that influences the quality of time spent on the task. Understanding what these relations are and how they emerge allows us to gain a deeper understanding of the processes that act upon an individual's or group's interest and development.

In sum, within this thesis, the notion of foregrounding some aspects of the plane, without losing sight of others, has been used as a means to better understand how the constitutional relations of a particular setting influenced the young people's creative collaborative processes, when using music technologies.

2.3.1 The mediating and transformational role of tools

In attempting to understand the interrelated nuances of particular cultural activities, Rogoff (1990, 1984) noted that transformations in learning were not only supported by more knowledgeable partners; sociocultural tools, culturally defined goals and problems, and social arrangements that emerged through participation in a joint activity also played an important role. Rogoff placed emphasis on the processes of communication and coordination of efforts, as well as the interpersonal processes in which people manage their own and others' roles, and structure situations. A fundamental tenet of sociocultural theory is that through participation in collective endeavours, not only is the individual's thinking transformed but so also is the cultural practice. Central to this transformation is the role of cultural signs or what Vygotsky termed 'semiotic mediation' (1978, 1981).

Semiotic mediation refers to the mastery of different tools or instruments by the individual, which leads to the reorganising and reconstructing of the individual's thinking and cognition. These tools can either be material (e.g. a computer) or symbolic (e.g. verbal language), or the behaviour of another human being in social interaction. Ashton (1996) points out that in Vygotsky's view of mediation, human thought emerged in the context of activities that are embedded in specific social and cultural settings. Wertsch (1991) refers to this as the 'sociocultural situatedness of cultural tools', in that tools are culturally, historically and institutionally situated and not 'neutral cognitive instruments' (Wertsch & Tulviste, 1998, p. 64). For example, written and oral communication is shaped by the styles of discourse that are preferred in the particular setting where the communication occurs. Wells (1986) further builds on this, noting that through cultural tools we mediate our thoughts and actions, which in turn helps us to regulate intra- and inter-personal processes, which leads to the creation of new problems and solutions. However, prior to using a tool or in order for a tool to transform individuals' ways of thinking, they must use and make this tool their own. This process of making tools 'one's own' has been termed *appropriation*.

2.3.2 Appropriation: making it your own

Appropriation is a complex process and relies not only on how the tools are designed or currently used, but also on how they are perceived by the individual and society who use them.

Rogoff (1995) argues that within the literature on appropriation the term has become confused with internalisation. For example, Newman, Griffin and Cole (1989) have discussed appropriation as the internalisation of something external, which is then transformed to fit the purposes of the new owner, through involvement in culturally organised activities in which the tool plays a role. This understanding has led to a somewhat passive conceptualisation of appropriation. It fails to emphasise the active participation in a social/cultural activity and mutually constitutive changes or transformations of individuals' interpretations of society's understandings of the activity, through the use of different tools (Rogoff, 1995).

Again, the concept of appropriation reiterates the sociocultural belief in the inherent mutuality between the individual and their environs. It is through active participation that people change their ideas, behaviours and thinking processes. In this they become prepared to engage in subsequent similar activities, maybe even transforming an activity through their own unique interpretation and approach to the activity and tools used (Newman et.al., 1989; Rogoff, 1995).

However, individuals' interpretations of an activity and society's prevailing or dominant understandings can cause tension, particularly when they are different (Goodnow, 1987). For example, Goodnow discussed how cognitive problems or tasks are bound by a culture's definition of the problem to be solved and its definition of 'proper' methods of solution. Goodnow contends that cultural values contain tacit understandings of what constitutes an appropriate goal, and proposes that individuals learn 'cognitive values'. In short, culture defines not only what its members should think or learn but also what they should ignore or treat as irrelevant.

If, however, the tension or difference is too great between the individual and their society, which in some cases it can be (e.g. in periods of cultural revolution or rebellion), the tension has to be resolved. This usually happens through the creation of new tools and social practices (Goodnow, 1987).

2.3.3 Sociocultural understandings and their relevance to this thesis

Prior to embarking on this thesis, the key interest was to explore the collaborative processes that people engage in when making music together. Through working in collaborative theatre and music-making settings, I had experienced first-hand how the social environment plays an important part in defining the quality of the collaborative experience and the kinds of content that emerge. In researching this area for the thesis, sociocultural theory provided a fitting framework through which to investigate such themes. Sociocultural theorists emphasise the mutuality between the individual and their social environs. Sociocultural theorists' multilayered approach to exploring this relationship provided a basis from which to examine how particular features of the context influenced young people's compositional processes. Concepts such as mediation and appropriation provided useful conceptual understandings, as well as a language through which to discuss how contextual features (such as the types of dialogues spoken, and the way the young people used the music technologies and made them their own) influenced and transformed the creative process.

However, what also emerged from this review is how complex it is to articulate the particular nuances and features of the *planes* or *levels* of context that influence participants' processes. Research in the field of situated learning and cross-cultural research helped illuminate these contextual features.

2.4 Situated learning: exploring learning in different settings

Situated learning provided a complementary approach to the sociocultural perspectives outlined in the above sections. In particular, it added to Rogoff's call to explore diverse cultural activities so as to gain a deeper understanding of how people learn. Situated learning researchers approached this issue by emphasising the need to understand everyday learning experiences in home and community settings (Brown, Collins, & Duguid, 1989; Lave, 1979, 1988; Lave & Wegner, 1991; Resnick & Resnick, 1989). This work stemmed from the concern that schools promoted superficial, abstracted learning situations rather than deep, meaningful and authentic learning experiences. One of the most influential researchers from this strand of sociocultural research has been the anthropologist Jean Lave. A key interest of Lave's (1979) was how people solved problems in everyday life as opposed to the lab-like, artificial, situations where most developmental studies, at the time (1970s), were taking place.

Taking a somewhat similar approach to Rogoff's planes of analysis, Lave (1979) attempted to look at how we solve problems through the lens of what she called the *outer environment* (i.e. the social and material context) and the *inner environment* (i.e. the subjective experience of working in each setting). Lave's (1979) main point was that the outer environment (the social and material features of everyday settings) is very different from experimental settings. For example, problem solving in everyday settings tends to be familiar and often routine, whereas experimental tasks tend, by design, to be unfamiliar to the subjects and can be unique and one-off. Everyday settings are also usually highly social, while lab-like settings are abstracted and decontextualised. However, Lave found that the inner environment (that is, the cognitions and processes we employ to solve the problems) can be very similar in both real-world and lab-like settings. For example, in examining how clothing tailors work, in experimental and everyday situations in the lab and the real world, Lave found their approach to maths and mental calculation required similar levels of attention and effort. However, in everyday situations, there are often competing demands on attention (e.g. serving customers). Consequently, problem solving is often interrupted and can span long periods, even days; while in experimental contexts, because the social setting is more highly controlled, there is less interference and problem solving is carried out quicker.

Although this finding may seem like common sense, Lave (1979) was one of the first to highlight the differences between experimental and everyday problem solving. Lave emphasised how in theorising learning we need to take into account differences in *performance* and *interactions* in different settings. In particular, she brought attention to the nuances of everyday learning and to the need to study both experimental and everyday problem solving, because it can help predict performance differences across contexts and lead to more advanced, applicable cognitive theories. Her ideas were extended in her book with Etienne Wenger, *Situated Learning, Legitimate Peripheral Participation* (Lave & Wenger, 1991), where, through a series of case studies of apprenticeships from tribal Yucatec midwives to Vai and Gola tailors, naval quartermasters and meat cutters, they discussed how newcomers or beginners become enculturated into a particular practice, through engagement with real, legitimate work that is connected to the work of the old-timers or masters. By 'learning-on-the-job', apprentices become socialised into the field as their participation becomes more central and legitimate.

Much of the work of Lave and Wenger focused on adult learning activities. Complementing this, many researchers (Brown, Collins, & Duguid, 1989; Carraher, Carraher, & Schliemann, 1985; Saxe, 1991) have added weight to their theoretical understandings, by focusing on the mathematical learning experiences of street children and whether their mathematical knowledge transferred beyond the immediate setting.

For example, Carraher, Carraher, and Schliemann (1985) examined how Brazilian children who were street vendors used informally learned counting systems to solve problems, although they had little success in solving similar problems in school. By contrast, Saxe (1991) reported that Oksapmin children learned a 'street' system of counting based on body parts that they were able to appropriate spontaneously to make sense of school maths. In another study of Brazilian children who sold sweets on the streets, Saxe found that, despite little schooling, the children had developed remarkable knowledge and problem-solving strategies (1991). Saxe also found that, when in school, candy sellers used their everyday, practice-linked knowledge to solve school problems. Thus there is evidence that children were able to appropriate knowledge and strategies mastered in informal environments and transfer them to formal education settings. The main finding from this body of work indicated that mathematical activity was guided more by the *situational constraints* rather than by formal mathematics principles learnt at school. What appears to be a key finding from these studies is that how the problem is *presented and perceived* by the children influences its transfer between different contexts.

Despite this, many researchers such as Resnick and Resnick (1989) have attempted to categorise the differences between school and so-called 'real-world' learning. According to Resnick and Resnick:

1) School learning promotes individual endeavour and cognition, while outside-school activities promote more shared learning opportunities.
2) School learning concentrates on promoting pure thought and abstract representations rather than the effective use of tools, which is required outside school.

3) School learning favours symbol manipulation, which is largely rejected outside of school because actions are more closely connected to the actual context of objects and events.
4) School learning promotes generalised, theoretical principles and skills rather than the situation-specific capabilities used outside of school.

Extending this work, Sternberg (1984) analysed the differences between the kinds of problems learners faced in academic situations and those they faced outside academia in more practical, everyday situations. They characterised academic, school-based problems as well-defined problems that are generally formulated by others. Such problems tend to be neatly presented, having only one method of solution and correct answer. Consequently, they tend to be disembodied from ordinary experience, and often of little or no intrinsic interest. These distinctions are similar to those found by Lave (1979) between experimental, lab-like and everyday learning. What this research highlights is that there are concrete as well as perceived differences between how 'inside' school and 'outside' school activities are generally organised.

Addressing this, Brown, Collins and Duguid (1989) have noted that, over the years, schools have developed a culture and community in which subjects are taught in certain ways. As schooling is in part developed to support mass education, the common approach to organising learning is through the development of a restricted subject-based curriculum where emphasis is placed on continual assessment and the attainment of standardised levels of accreditation.

Brown et al. were the first to apply situated learning principles to a model of classroom-based practice, arguing that meaningful learning will only take place if it is embedded in the social and physical context within which it will be used. According to Brown et al., for meaningful learning to occur, students have to become enculturated into the community of the subject matter. This approach to learning is at the heart of contemporary educational thinking. As outlined in the introductory chapter to this thesis, deep engagement with the subject matter in authentic learning situations has proven to lead to productive, lifelong learning experiences. This understanding is also at the heart of thinking from an non-formal learning perspective.

2.4.1 Defining formal and non-formal learning

Alongside terms such as 'everyday learning', 'real world' and 'authentic learning', 'non-formal learning' has also been used to describe the type of learning that occurs outside of formal institutional settings. This section outlines what is meant by the terms formal and non-formal learning and how the understandings of these terms also highlight the complex differences between various kinds of learning experiences.

Formal learning settings have been considered to be hierarchically structured and chronologically graded learning situations, where prescribed learning frameworks, organised learning events and the presence of a designated teacher or trainer is the norm (Eraut, 2000; Smith, 1988; Smith & Jeffs, 1990). In comparison, non-formal settings have been deemed to be learning situations that take place outside dedicated learning environments and that arise from the activities and interests of individuals or groups (Marsick & Watkins, 1990; McGivney, 1999). This definition of non-formal learning shares some of the characteristics of what Lave (2004) and Lave & Wenger (1991) consider as 'real' problems that arise from everyday situations and are generally related to the individual's motivations and interests. Similarly, this idea of non-formal learning has links with what Sternberg (1984) identified as the ill-defined nature of everyday problems, that is, problems which require substantial information seeking; have multiple methods of solution and therefore have a variety of 'correct answers'. Such problems are often considered as highly motivating and emotionally involving learning situations (McGivney, 1999; Smith, 1988). In Chapter 5, we shall see how such definitions of ill-defined problems complement the research in creativity and creative thinking.

However, distinguishing formal and non-formal learning settings is more complex than simply characterising well- and ill-defined problem situations. As Sefton-Green (2003) acknowledges, what constitutes 'learning' in non-formal settings raises a provocative set of questions about what might be learnt outside the formal curriculum. Taking a similar view to others in the area (Marsick & Watkins, 1990; McGivney, 1999), Sefton-Green sees formal and non-formal as lying on a continuum. However, he also explicitly distinguishes the *learning setting* from the *learning organisation*. For example, on the continuum between formal and non-formal learning *settings*, there is the learning that occurs in formal (e.g. school), semi-formal (e.g. museums), and non-formal settings (e.g. families and friendship groups). On the continuum between formally and non-formally *organised* learning lies, at one end, learning that occurs explicitly through, for example, formally organised lessons and, at the other end, implicit (or accidental) learning that can occur while playing a computer game. What Sefton-Green and others (Marsick & Watkins, 1990; McGivney, 1999) are attempting to articulate is that both formal and non-formal learning can occur in the same space and that defining the differences between them can be extremely complex.

The complexity of the empirical research in this area is partially due to differences in research focus and agenda. For example, the research on everyday and real-world learning (see Section 2.4 and the work of Carraher, Carraher, & Schliemann, 1985; Lave, 1988; Resnick & Resnick, 1989; Saxe, 1991) has predominantly been driven by the need to address educational inequalities in 'First' and 'Third' World countries. Eraut's (1994; 2000), Marsick and Watson's (1990) and McGivney's (1994) work has concentrated on non-formal learning within the professional, commercial and business sectors. Smith and Jeffs' (1990) and Sefton-Green's (2003) work has, to varying degrees, considered non-formal learning in relation to young people, in particular in youth work (Smith, 1988; Smith & Jeffs, 1990) and community college arts training (Sefton-Green, 2003b). Despite the different agendas behind these different strands of non-formal learning research, similar understandings have been reached: that the distinctions between formal and non-formal learning are complex, and that the learning *setting* and it's *organisation* influence the kind of learning that takes place.

Despite this, there still is a dearth of systematic studies on how different kinds of settings influence participant interactions in creative, open-ended collaborative situations. This thesis makes a new contribution to the area by addressing this very topic.

2.5 Concluding thoughts

In sum, this chapter introduced the main sociocultural framework which informed this thesis. Due to the inherent emphasis on the mutuality between an individual and their environments, sociocultural theory provided a supportive framework through which to understand how particular task settings can influence participant creative collaborations. In particular, sociocultural theorists emphasise the mediational role of psychological and physical tools and how they can transform the kinds of interactions that occur within a particular context, as people appropriate or make tools their own. By bringing this work together with understandings from situated learning, cross-cultural studies and research in formal and non-formal learning, a richer understanding of how best to conceptualise context was achieved.

From this multiple perspective, context is best considered as the interweaving of various constitutional relations, though which the task, participant, institutional setting and wider cultural organisations are connected. The importance of understanding the influence of such relations on participant processes and interactions was clearly highlighted in the work carried out on everyday problem solving and that which compared school and non-school problem solving. From this body of work the main finding was that differences in performance and interaction depend on the setting in which the learning activity takes place and how various features within it are organised. Understanding the organisational form the varying constitutional relations take and the processes which influence them was the key to understanding how learning occurred and transferred between different settings.

For example, where the learning takes place, how it is organised, what type of task it is, how it is perceived and presented by the learner, what their role is within the task and who is supporting them are important influencing features. To best understand how these various features influence each other, it is useful to foreground one, without losing sight of its inherent relation to the others.

In taking a multilayered approach within this thesis, it is anticipated that some of the gaps in our knowledge, particularly in relation to creative collaboration, can be filled. For example, we know little about the kinds of non-formal learning processes that occur in school settings or the formal learning processes that occur within non-formal settings. Additionally, there has been an overemphasis on certain subject areas – for example, much work has been carried out on children's understanding of maths in school and non-formal settings. Consequently, we know nothing about the processes young people engage in when making music using music technologies in formal and non-formal settings. Therefore, to understand how young people create meaning when working together in different music technology settings, we urgently need to examine how participants call upon the constitutional features of the setting and weave them together.

To examine such questions, a review of how sociocultural researchers tried to address this problem to date is necessary. The following chapter examines this by focusing one of the key semiotic tools explored within this thesis - verbal dialogue and, in particular, the kinds of dialogues young people engage in when working in computer-mediated collaborative settings.

3. The role of dialogue in collaborative learning

3.1 Introduction

This chapter discusses in detail the role of dialogue in collaborative learning. The work largely stems from Vygotsky's emphasis on semiotic mediation (as discussed in Chapter 2, Section 2.3.1). Semiotic mediation emphasises how psychological (e.g. dialogue) and physical (e.g. computers) tools can transform thought and action. Given that one of the key research questions addressed in this thesis concerned the kinds of verbal dialogues young people engage in when working with music technologies in different settings, a sociocultural perspective provided a particularly useful lens through which to examine this area. In particular, this perspective provided a way to better understand how active participation in cultural practices such as music making develops their ideas. It is also important to state that, although other educational perspectives, such as Piaget's perspectives (1977; 1980; 1985) and those of neo-Piagetian theorists (Cobb, 1996, p.50; Sfard, 1991) were examined during the research process, they did not explicitly inform this thesis.

One reason for not drawing so heavily on the Piagetian approach is that Piaget (particularly his early work) and neo-Piagetian theorists take the *individual's internal*, cognitive processes and their reorganisation as the bases for development. It is not that Piaget ignored the social bases for development, but given that this thesis was interested in such relations, a sociocultural and situated-learning perspective better suited the aims of the work.

In sum, the rationale for carrying out a dialogical analysis of musical collaborations was based on evidence from the collaborative-learning literature. Through analysis of participant verbal dialogue, the assumption was that one could gain insight into the nature of how participants weave together the different constitutional relations within a given task setting in order to co-create and reach a shared understanding of the task. In analysing their verbal interactions it was believed that a more informed understanding of participant collaborative and creative interactions could be arrived at. Taking this position, the research presented in this chapter provided the necessary grounding from which the methodological framework (as presented in Chapter 8 of this thesis) was derived.

3.1.1 Learning to understand each other

In attempting to explain how people reach a shared consensus, sociocultural theorists have explored how people coordinate their efforts or contributions when working on a shared task; that is, how they achieve *intersubjectivity* (Matusov, 2001; Smolka, De Goes, & Pino, 1995).

Traditionally, intersubjectivity has been considered as a state of overlapping individual 'subjectivities' or 'prolepses' (Rommetveit, 1979; 1998). Prolepses refers to a communicative move in which a speaker presupposes or takes for granted something that has not yet been discussed at the time of the move. For example, prolepses can take the form of the speaker's assumptions about the listener's background knowledge. Methodologically this has been investigated: 1) in relation to time, sequential moments (beginning, middle, end) of joint activity; and 2) in relation to overlapping subjectivities as having something in common, as the coordination of participants' contributions and as participation. Generally the outcomes are considered successful when participants in an activity have reached similar prolepses – that is, they share or divide up their subjectivities (Cole, 1991). This has been understood in numerous ways.

For example, Wells (1986) investigated the preconditions of joint classroom activity, defining intersubjectivity as having a common background. Murray and Trevarthen (1986) focused on the emerging intersubjectivity in mother-infant joint activity, discussing it in relation to infants coordinating their movements and eye contact with their mothers. Trevarthen (Trevarthen 1994; Trevarthen & Logotheti, 1989) summarised intersubjectivity as the process through which mental activity, including conscious awareness, intentions, cognitions, and emotions, are transferred through shared joint attention and motivation. Wertsch (1979) focused on the intermediate and end moments of intersubjectivity, examining the growing commonality of participant definitions of situations, and the outcome of guidance as the child becomes an independent problem solver.

In critiquing such work, Matusov (2001) notes that researchers have tended to overemphasise agreement and symmetry among individuals, thus reducing joint activity to the simple sum of individual activities. For Matusov, traditional perspectives on intersubjectivity overemphasised the sharing, reproductive aspects of learning at the expense of its productive, creative aspects, as they did not account for how something new develops in a joint activity, and the emerging diversities that can develop among participants.

Similarly, Smolka et al. (1995) also discussed this issue, noting that original understanding of intersubjectivity overemphasised the process of unification or of shared subjectivities. If agreement did not occur, it was considered that the joint activity was a failure. This is misleading as it is almost impossible to achieve a complete overlap of two individuals' subjective perspectives, even if the participants are very alike (e.g. they share similar cultural, socio-economic backgrounds), because each individual will have a similar, but also unique, understanding of the situation.

Consequently, Matusov (2001) calls for a new participatory approach to intersubjectivity that focuses on how participants coordinate their contributions though joint activity, oriented either towards achieving consensus (e.g. agreements, positive support) or non-consensus (e.g. disputes, conflict). This shifts focus away from what each individual is trying to accomplish during the task, towards focusing on how individuals' contributions are coordinated with each other during the activity. Thus a participatory notion of intersubjectivity is joint-activity-orientated rather than individual-orientated. Importantly, it attempts to take into account how individuals' contributions (i.e. what they do and say) can transcend an individual perspective (i.e. what they may actually 'feel' or believe) about the joint activity and how this decreases and increases over the task. Additionally, this perspective on intersubjectivity also acknowledges how participants influence each other's thinking. For example, if the teacher interprets a child's sounds as a song, the child begins to learn new opportunities for expression. This allows the child to work independently but simultaneously also provides new areas and levels of adult-child misunderstandings that previously did not exist.

In sum, in any joint activity there are multiple agendas, goals, settings, and individuals with different intentions. To best understand the dynamics involved requires exploration and acknowledgment of the role of agreements, disengagements and the coordination of participant contributions. In this thesis, intersubjectivity was considered as the process of the coordination of individual similar and diverse contributions to a joint activity.

3.1.2 Co-constructing new ideas

Co-construction is inherent to intersubjectivity and successful collaboration (Damon & Killen, 1982; Rafal, 1996). During the co-constructive process each individual's understanding must be reciprocated (Leseman, Rollenberg & Gebhardt, 2000). Reciprocal understanding has been highlighted as an essential prerequisite for collaborative learning (Kumpulainen & Mutanen, 1999; Littleton & Häkkinen, 1999), and involves individuals establishing a shared or common understanding of the task (Edwards & Mercer, 1987), as well as an understanding of their individual differences (Matusov, 2001). In this respect co-construction and intersubjectivity are interdependent, and both are necessary for successful collaboration. However, as with many sociocultural terms, the term 'co-construction' itself is elusive, with researchers defining and analysing it differently. In general co-construction is a process that has been used in two different ways to refer to collaborative interactions: 1) to describe expert-novice learning relationships. Chi (1997) has referred to this as 'scaffolded co-construction'; 2) to describe the interactions between two peers, with similar symmetrical understandings. For the purpose of this thesis, this latter notion of co-construction will be discussed in more detail, as it is more akin to the understandings and interactions examined.

Co-construction has been generally understood as how knowledge and understanding are constructed by individuals engaging together in talk and activity about their shared problems or tasks (Driver, Guesne, & Tiberghien, 1998). Central to this view are participants' mutual efforts to create knowledge, which have been examined by researchers interested in distributed reasoning (Barron, 2003), novelty of solutions (Ames & Murray, 1982), and the interactive quality of the dialogical process (Kruger, 1993).

In considering co-construction as a form of distributed reasoning, Barron (2003), drawing heavily from Rafal (1996), concluded that the new solution is a combination of both partners' thinking. Barron found co-construction occurs when: a) participants make statements that, taken individually, *do not* represent complete ideas; b) participants make utterances that, taken together across speakers, either complete or continue another participant's ideas; or c) both (a) and (b). Extending Barron's characteristic features of co-construction, Ames & Murray (1982) also emphasised that co-construction was the result of *jointly* produced knowledge that was *novel* to both partners. Adding to this, Kruger (1993) noted that, during co-construction, each person is significantly contributing to the ongoing dialogue. From Kruger's perspective, a solution was considered as co-constructed if it 'substantially altered in the process of discussion' (Kruger, 1993, p. 170). In this respect, both partners alone could not generate the same solution.

In further considering the key characteristics of co-construction, Hausmann, Chi and Roy (2004) differentiated between *elaborative* co-construction and *critical* co-construction.

Elaborative co-construction was defined 'as one partner adding a significant contribution to the discourse that develops another person's idea' (Hausmann, Chi, & Roy, 2004, p. 4), while critical co-construction was the process where peers critically evaluated each other's ideas. In their study of university students, (10 dyads) interactions when solving a physics problem, they found that overall co-constructive episodes were rare (only 20% of the interaction). Of this, 42% were elaborative and 58% critical co-construction, with critical co-construction leading to slightly more correct applications of physics concepts in the post-test trials. However, despite this result, and due to the small sample size, they could not tell if elaborative or critical co-construction was significantly more effective in subsequent learning. Again, the results of this study indicate that both types of co-construction may be equally important and even interdependent, but serve to facilitate different aspects of the learning experience.

Similarly, Van Boxtel (2000) distinguished between elaboration and co-construction, considering co-construction as a superordinate category, with elaboration a subordinate category. Von Boxtel and colleagues, in their study of how students used different resources (concept maps, books, experiments) to solve physics tasks, also found that co-construction was rare and that elaboration could also lead to more in-depth understandings.

Concepts such as elaboration or elaborative co-construction link with what Mercer (1995) terms 'cumulative talk', where partners add to each other's ideas but do not question, challenge or contradict their partner (this type of talk will be discussed in detail in Section 3.2.1). Typically, this type of talk has not considered as an indicator of successful collaboration.

Again, there is an underlying assumption that conflict, or logical-deductive methods of reasoning (argument - counter argument) are the only way to achieve deep or real learning. This is despite evidence which shows that elaborative types of reasoning, where partners don't engage in such verbal transactions, can also lead to productive and engaged learning moments. In more recent years some researchers (Hausmann, Chi, & Roy, 2004; Wegerif, 2004) have considered that elaboration or cumulative types of talk may be responsible for certain types of collaborative learning and problem solving. This is discussed in more detail in the following sections.

3.2 Exploring collaborative talk

In examining the dialogical mechanisms underlying co-construction, sociocultural researchers have examined what kinds of talk are necessary for it to occur. Numerous researchers have developed different labels for the type of talk they consider as indicative of co-construction and successful collaboration. The results of this research can be discussed by examining: 1) 'transactive' talk; 2) 'exploratory' talk and 3) contemporary sociocultural perspectives on collaborative talk. The following sections deal in turn with each of these types of talk.

3.2.1 Transactive talk

Berkowitz and Gibbs (1983) were the first to coin the term 'transactive discussions', that is, reasoning that operates on the reasoning of another. In their examination of undergraduates' dyadic discussions on moral reasoning tasks, they found that transactive discussions could lead to developments in reasoning about moral issues. In their analysis, Berkowitz & Gibbs identified 18 types of transactive behaviours (transacts). The two main kinds were *representational* (representations of another's reasoning) and *operational* (transformations on another's reasoning) transacts. Their findings concluded that operational transacts were more important as they were associated with advancements in moral reasoning.

Kruger & Tomasello (1986) also examined the effects of transactive discussions on children's moral reasoning, examining child-peer and child-adult transacts when discussing moral problems. They hypothesised that children would engage in more transactive dialogues with peers, because these potentially allowed for a more egalitarian dyadic structure, as opposed to child-adult discussions. Their findings supported this, as a greater proportion of the experimental groups' conversational turns were identified as transactive when children were paired with a peer than when paired with an adult. In follow-up studies, Kruger (1993) explored the role of dyadic interaction and how it changed children's moral reasoning. Her hypothesis was based on the findings from the first study (Kruger & Tomasello, 1986) that transactive discussions were positively related to developments in moral reasoning and that such discussions occurred more in child-peer than adult-child dyads.

In sum, Kruger's work indicated that peer interaction does support developments in moral reasoning and that there are qualitative differences in the types of talk engaged in when paired with a peer rather than an adult. Similar to Berkowitz and Gibbs's (1983) findings, Kruger concluded that it was the active engagement with another's reasoning, rather than conflict or argumentation, that was central to advancements in one's thinking.

The above work is linked to the topic of this thesis through MacDonald & Miell's (2000; 2002) examination of transactive dialogues in their studies of collaborative music tasks. In their first study (2000), 20 dyads (11 to 12 year olds, with one partner having had at least some experience of formal instrumental music lessons and the other with no experience) were either made up of mutual friends from the same class or children from different classes who had not nominated each other as a friend. The friendship and non-friendship pairs collaborated on a music task, which involved composing and recording a piece of music about the rainforest. The dyads' dialogues were analysed using the transactive coding scheme used by Kruger (1993; Kruger & Tomasello, 1986) and by Berkowitz & Gibbs (1983). Besides examining the young people's verbal dialogues, MacDonald & Miell (2000; 2002) extended the coding scheme to allow them to also examine the nature of the dyads' musical communication and the extent to which participants built on and developed each other's musical contributions (i.e. used transactive musical communication). They found that the relationship between the partners' was an important factor and influenced the quality of both the verbal and musical communication engaged in, with friends using more transactive communication. This study provides some evidence of the importance of understanding the constitutional relations that can and do influence how we work together.

3.2.2 Exploratory talk

Exploratory talk also has its roots within sociocultural research on how participants jointly co-construct a shared understanding of a task. The researchers who have defined and investigated this type of talk are Mercer and colleagues (Dawes, Fisher, & Mercer, 1992; Mercer, 1994, 1996; Mercer, Wegerif, & Dawes, 1999; Wegerif & Mercer, 1996, 1997).

Collectively, they have examined how certain types of dialogue can assist learners in 'thinking together'.

To learn how to think together productively, learners need to establish ground rules for talk. Mercer and his colleagues (Dawes, Fisher, & Mercer, 1992; Mercer, 1994, 1996; Mercer, Wegerif, & Dawes, 1999; Wegerif & Mercer, 1996, 1997) have developed the notion of ground rules and how to teach them to children. They believed children did not necessarily know how to engage in the types of talk that lead to 'real' learning and deep understanding. One approach to this is to teach them forms of talk that the researchers believe can lead to a more productive learning, such as exploratory talk.

'Exploratory talk' is characterised by the sharing of ideas as well as joint thinking and decision making through resolving conflicts, challenging ideas and assumptions, providing justifications for ideas and giving well-argued proposals. Exploratory talk, for Mercer and colleagues, represents a:

> ... distinctive social mode of thinking – a way of using language which is not only the embodiment of critical thinking, but which is also essential for successful participation in 'educated' communities of discourse (such as those associated with the practice of law, science, technology, the arts, business administrations and politics. (Mercer & Wegerif, 1999, p. 88)

To ensure that learners increase exploratory types of talk, and therefore engage in more constructive educational discourses, Mercer and colleagues designed some basic ground rules, such as: 1) discuss things together, that is, ask everyone for their opinions, ask for reasons why, and listen to other people; 2) be prepared to change you mind; 3) respect other people's ideas - don't just use you own; 4) share all the ideas and information you have' (adapted from Wegerif, Mercer, & Dawes, 1999). Much of the work by Mercer *et al.* has concentrated on examining the benefits of applying such ground rules for exploratory talk and designing various intervention programmes to test how successful the ground rules were. For example, as part of their Talk, Reasoning and Computers (TRAC) programme, Wegerif, Mercer, & Dawes (1999) examined 60 children aged 9-10. These children were divided into target and control classes. Pre-and post-test scores were taken using the Raven's Standard Progressive Test (Raven, Court, & Raven, 1995), which consisted of graphical puzzles widely used to test non-verbal reasoning. The intervention programme involved providing teachers with a lesson plan, which they could use in class.

Not surprisingly, they found that teaching the ground rules for exploratory talk did facilitate groups' learning and general reasoning. Mercer and colleagues have found similar improvements in the quality of pupils' collaborative learning after intervention programmes in classroom studies, and in the different curriculum areas of science and citizenship (Wegerif, Mercer, & Dawes, 1998). This led them to believe that teaching the ground rules for exploratory talk is beneficial to improving pupils' collaborative reasoning generally.

In analysing types of talk that they found emerging in classroom contexts, Mercer and colleagues developed an analytical framework which is often cited in discussions on collaborative dialogue (Edwards & Mercer, 1987; Mercer, 1994; Mercer, 1995; Wegerif & Mercer, 1997).

Their framework categorises talk into three distinct modes or typologies, which relate to different ways of 'thinking together':

- *Disputational talk* is unproductive talk, characterised by disagreements, which are followed by individual decision-making.
- *Cumulative talk* consists of positive but uncritical decision-making, where suggestions are either accepted without discussion or with only superficial amendments. According to Mercer et al., partners use cumulative talk to construct a 'common knowledge' by accumulation, and such periods of talk are characterised by repetitions, confirmations and elaborations.
- *Exploratory talk* is seen as the most effective and productive mode of interaction. According to Mercer and Wegerif (1999), it is the 'communicative process for reasoning through talk in the context of some specific joint activity' (p. 88). Exploratory talk is characterised by the sharing of ideas, joint thinking and decision-making through resolving conflict, challenging views, giving rationales and justification for thinking and well-argued proposals. Exploratory talk is considered to foster critical thinking and represent a more explicit pursuit of consensus through conversation.

Although Mercer et al.'s research has had a significant impact on understanding what kinds of dialogue can lead to productive collaboration, their work has tended to focus on the benefits of teaching specific ground rules and the outcomes of such interventions. Additionally, their central arguments rest on the importance of logical-deductive reasoning as facilitated through exploratory talk. They conclude that it is not surprising to find that exploratory talk is rare because the necessary skills to foster it need to be taught.

However, while this may be the case, exploratory, logical-deductive types of talk may not necessarily be the most suitable forms of dialogue to engage in for all tasks and could in some cases even be detrimental to the production and flow of creative ideas. This issue is discussed in more detail in the following section.

3.2.3 Contemporary perspectives

As noted so far in this review of collaborative dialogue, much of the work conducted has tended to focus on logical reasoning tasks, such as in scientific, legal and moral areas. In more recent years, many researchers have been examining more open-ended or ill-defined tasks, where there is no 'correct' or 'fixed' solution. Much of this work has found that exploratory talk does not occur spontaneously during such collaborations, and, importantly, that it may not be a prerequisite or indicator of a successful collaboration. For example, Kumpulainen's (1996) study of young people's collaborations on open-ended writing tasks using word processors in British and Finnish schools showed that children exchanged knowledge via talk and negotiated their understandings, but *without* engaging in what Mercer et al. would call exploratory talk. Kumpulainen analysed the dialogues using a functional analysis system that focused on the use and purposes of dialogue, and found that the knowledge children exchanged was derived not only from the school context but also from other contexts in which the children were involved, such as their everyday home life.

In addition, Kumpulainen found that although the young people engaged in various types of talk, such as questioning, agreements, disagreements and discussions about how the writing should be created, pupils seldom justified or provided explicit reasons within their discussions. The talk engaged in was generally procedural, and related to the task. Similar findings were also found by Kumpulainen and Mutanen (1999) in their later analysis of talk between pairs of young people (aged 12 years) working on classroom-based geometry tasks.

Even when considering more scientific-based tasks like this, Van Boxtel (2000), in her analysis of young people's (aged 15-16 years) physics-based tasks (using concept mapping and posters to examine ideas around electricity), found that students did not commonly engage spontaneously in exploratory types of talk or justify their arguments. Van Boxtel found that, during conflict, the issues were discussed but not necessarily resolved. This is an interesting point, which reiterates the previous points raised when discussing issues around participatory intersubjectivity (Matusov, 2001), that people (even when working on a shared task and successful completing it) may not necessarily share the same views on the task. It is worth speculating why, in some circumstances, conflicts are discussed but not resolved. It might be the case that, in such situations, the group's cohesion is valued more than conflict resolution. The work of Kumpulainen, Von Boxtel and colleagues indicates that within educational research there are many social and relational issues, which we tend to ignore or pass over in our analysis and understanding of learning. The challenge for contemporary researchers in this field is to address these issues because better understandings could lead to improved educational interventions and learning environments.

3.3 Conclusions on the role of dialogue within collaboration

This chapter began with an in-depth explanation of the key terms involved in understanding how people and cultures appropriate and make tools their own, using them to express themselves in new ways. The nuances of how we express ourselves were addressed through the lens of intersubjectivity and co-construction; both terms attempt to uncover the subtle ways through which we achieve and acknowledge our diverse and shared understandings in a given situation. The main point raised was that there has been a shift away from overemphasising the importance of agreement and consensus-seeking to exploring how new and different ideas are introduced in joint activity. Failure to acknowledge this aspect of collaborative activity had permeated our early notions of 'successful' dialogues.

Within contemporary dialogical understandings of learning, the role of conflict and argument is now also considered as central to successful collaborative learning. This led to a body of research on the importance of logical-deductive modes of dialogical enragement; but more recently it has begun to emerge that such types of talk may not be suitable for all forms of collaboration. Elaboration and the active engagement in another's thought process was also shown to be as important as argumentation in transforming a person's thinking, with other factors such as friendship and the type of relationship (adult-child or peer), plus type of task, also influencing the process.

Such findings led to the conclusion that language is an essentially situated and context-sensitive medium (Wells, 1986; Wertsch, 1991).

Yet despite numerous researchers (Barbieri & Light, 1992; Crook, 2000; Van Boxtel, 2000) calling for the need to investigate a wider range of collaborative task domains, research to date has tended to overemphasise the thinking and dialogical processes involved in certain types of task (e.g. science, maths). Consequently, there is an increasing need to focus on the specific kinds of thinking different activities support and the constitutional relations and features that influence such thinking. To date, there has been relatively little research on the dialogical mechanisms that emerge when collaborating on open-ended, music tasks. This thesis addresses this gap by focusing specifically on the verbal interactions that emerge when young people work on creative tasks collaboratively using music technologies.

4. The role of computers in collaborative learning and music

The second key research question addressed in this thesis focused on the mediational role of the keyboard and computer-based music technologies in the creative collaborative process. The term 'music technology' is used throughout this thesis and refers to any 'situation in which electronic technology is used to control, manipulate or communicate musical information' (Murray, 1997). Although the term 'information communication technologies' (ICT) is often used in the literature in this area, to refer to the application of computer-based technologies for learning, the term 'music technologies' is preferred, as it's considered more appropriate and it encompasses recent advancements in digital, online, locative and wireless media.

As noted in Chapters 2 and 3, sociocultural theorists consider physical tools, such as computers, important mediational tools, as they can transform how we communicate with each other and how we understand our worlds. Within this thesis, two types of music technology were specifically examined – keyboards and computers. The research on keyboards within music education will be discussed in detail in Chapter 9. Chapter 4 will focus on the application of computers within classroom-based settings, particularly in relation to music, and why such research is necessary in today's digitally mediated worlds.

4.1 Overview of computers in education

Collaborative computer-based learning stems from a variety of traditions (Light & Littleton, 1999), such as computer-assisted learning (CAL) and Microworld research, such as Logo (Papert, 1980). This early work on the role of computers found that they could facilitate peer interaction (Webb, Ender, & Lewis, 1986) and particular skills, such as drill and practice (CAL) and programming skills (Logo). In the 1980s, classroom observations suggested that most educational use of computers involved pairs or small groups, rather than individuals, and that these pairs or small groups often worked relatively independently of the class teacher (Jackson, Fletcher, & Messer, 1986). This led to a recognition of the need to design learning environments that facilitated social interaction, cooperation and collaboration in the classroom (Crook, 1994, 1998; Vosniadou, 1996).

Since the late 1980s, much research has been conducted on how computers can facilitate the learning process and what types of interaction occur when working with them. Such studies tended to follow the pre- and post-test methodological format; first, by examining children's individual computer work (pre-test); second, running a collaborative group activity (test); third, examining the outcomes of the learning (post-test) and comparing this with the individual pre-test scores.

Outcomes of such research tended to vary, with many researchers finding that collaborative learning in pairs and small groups around computers can lead to learning (Barbieri & Light, 1992; Jackson, Fletcher, & Messer, 1992), while others found it did not (Light, Foot, Colbourn, & McClelland, 1987). Critically, reviews of such work (Barbieri & Light, 1992; Dillenbourg, 1999; Issroff, 1995) have shown that variations in results were due to differences in, for example, task, setting, participant numbers and abilities, and experimenters' instructions.

In relation to the research topic of this thesis, Crook (1994) notes that one of the most important features of computers is that they can reorganise classroom-based activities and lead to new ways thinking. Crook's (1994) view of computers as powerful contemporary organisational learning devices links to the opening theoretical chapters of this thesis, where the argument was made for the importance of examining how the features of the particular setting influence learning. Taking this view, it seems appropriate within this technologically orientated thesis to focus on the role of computers within the settings examined. Following this thread, other researchers have also found that computers can:

1. Provide a framework or background for verbal intervention on planning, negotiation and problem solving (Howe, Tolmie, Anderson, & Mackenzie, 1992; Light, Littleton, Messer, & Joiner, 1984). For example Howe et al., (1992) found that software obliged pupils to make their predictions explicit and to come to agreement which proved beneficial for learning.

2. Assist in curriculum development and teacher-pupil interactions. For example, research conducted by Wegerif et al., (1998) within their project on Spoken Language and New Technology (SLANT) specifically examined how software can create situations in which pupils are obliged to make their predications and agreements explicit. They examined learning situations in which the software

content was integrated with a programme of off-computer lessons; where the software was specifically designed to support collaborative learning and the school curriculum. Wegerif et al. examined children's (aged 9-10) interactions around computers in classrooms on both science and citizenship tasks. They showed that the quality of interaction around computers can be improved by off-computer coaching in the ground rules for exploratory talk (see Section 3.2.2), and that this design is effective in stimulating talk which supports citizenship- and science-based curriculum tasks.

Although points 1 and 2 highlight the advantages of computers, it could be argued that any well-designed learning activity with adequate teacher support could produce similar outcomes; that is, a solid framework for problem-solving and advanced curriculum skills. So what in particular makes computers or digital technologies 'special', what do they uniquely add to the learning context?

4.1.1 Digital technologies – what do they uniquely contribute to the learning experience?

In attempting to examine how computers in particular provide new learning opportunities, Hoyles and colleagues (Hoyles, 1991; Hoyles, Healy & Pozzi, 1992) examined in detail how different computer-based working conditions led to different outcomes. In their 1991 study they found that, within computer-based tasks, more on-task talk occurred when compared to non-computer-based (pencil-and-paper) tasks. Both the software and the task structure influenced the kinds of processes engaged in, and both had a strong influence on the nature of the pupils' interactions and their problem-solving negotiations. Hoyles et al. also found that with computer-based tasks, the process of *formalising the problem* became an integral part of the activity. In particular, Hoyles et al. (1992) found that the shared visual computer screen and single input mechanism (mouse and keyboard) forced children to work together by drawing their attention to the same things and acting as a focus for discussions. To summarise, Hoyles and colleagues found that the unique properties of the computer, such as its screen, input device and the software design, provided a novel scaffold or supportive framework from which the participants could engage in more complex co-constructive, joint interactions. This finding is very relevant to the research carried out in this thesis, which specifically explored how the constitutional relations within a particular setting played a role in the ongoing creative process. Hoyles et al.'s work provides a strong indication of how relations such as the software design can play a part in the learning process, but also how technologies uniquely contribute to such interactions.

According to Hoyles et al. (1992), the group dynamics around the computer can only be adequately understood by considering the interrelationship between the group, the task and the software. They examined eight groups (mixed male and female groups of six, between the ages of 9 and 12 years) working on three different types of maths computer software (two different Logo tasks and one database task). They found that the task design and the software played an important role in pupil interdependence and autonomy. Interestingly, they found that participants who worked most successfully together did not engage in discussions about their diverse viewpoints or disagree over the strategies to adopt. This finding contradicts Wegerif et al. (1998) and Howe et al. (Howe, Tolmie, Anderson, & Mackenzie, 1992). One of the reasons Hoyles et al. suggested for this finding was that computers provided alternative and detailed communication support mechanisms for children, which reduced the need to communicate explicitly verbally. For example, the computer screen allowed them to 'do' things and 'show' each other their ideas, without engaging in extended explicit reasoning. This finding is relevant to this thesis as it provides the basis for thinking that, in computer-based musical collaborations, the need for detailed exploratory talk may be reduced or eradicated, as participants work together by 'doing' and 'showing' and, in the case of music, 'listening' to each other. Alongside talking, doing, showing and listening together form the basis on which partners communicate, negotiate, share and co-create meaning.

Returning to the specific, specialised features that computers bring to learning, Koschmann, Feltovitchh & Burrows (1986) identified five key ways in which they are unique. Computers can:

- Provide a means to simulate real-world problems
- Mediate communication
- Introduce new resources
- Can be used for archival storage
- Can be used to represent and manipulate forms

In addition, computers automate certain procedural functions (e.g. saving, storing, retrieving data), which has led to greater speed in how we work and communicate. This power facilitates more interactive, connected/networked-learning opportunities. As a result, traditional boundaries of time and space have been overcome (Scanlon, O'Shea, Smith, & Joiner, 2000). We can now work simultaneously on tasks despite differences in time zone, location and so forth. This is an important and unique aspect of computerised, digital tools, which has resulted in new opportunities for the coordination and joint construction of knowledge (Fitzpatrick & Hardman, 2000).

However, in relation to this thesis, it is computers' specialised ability simultaneously to represent and manipulate different forms and objects that is of particular interest. Computing and digital technologies have the power to combine graphics, sound and texts. Consequently, it has been argued that they support multiple modes of communication, which can lead to the restructuring of how cognitive tasks are undertaken (Crook, 1994).

The multimodal functionality of computers (i.e. their ability to allow users simultaneously to communicate using text, graphics, sound and so forth) has been specifically addressed by The New London Group (1996). The New London Group (an international group of interdisciplinary researchers) wrote a seminal article 'A pedagogy of multiliteracies: designing social futures' (1996), which discussed how digital tools allow us to become the authors and producers of our own material. Many researchers (Buckingham, 2000; Ellis & Loveless, 2001; Facer, Furlong, & Sutherland, 2003; Gee, 2003; Snyder, 2002a, 2002b) use the term 'multiliteracy' to discuss how ICT has changed what it means to be literate within the digital age. In contemporary society, being literate now refers to more than just reading and writing – it also refers to the ability to understand the complexities of written, oral and audiovisual modalities of digital communication. One of the most prolific writers in this field has been John Paul Gee (1996, 2003, 2004). Recently, he has discussed the learning potential of video games (2003), examining their uses through the lens of multiliteracy.

Gee considers video games as 'multimodal texts' belonging to distinct 'semiotic domains' that employ a range of strategies in which images and words, sounds, music, movement and bodily sensations are factors. He argues that these semiotic domains are constantly being produced and re-produced by the peer groups or 'affinity groups' that form though game-playing. Borrowing some of Gee's notions, music technologies can also be considered as multimodal texts that belong to semiotic domains in which image, sound, music, movement and bodily sensations are at play.

Additionally, through the act of music creation, young musicians are identifying or affiliating themselves with the wider musical community and cultural practices (e.g. styles of dress, visual identities) related to the work they are producing. In this sense, making music is more than just learning how to produce a certain composition, but is also about wider social processes, such as learning the nuances, meanings and behaviours that are associated with the culture of the music you are producing. This links well to arguments presented in the first theoretical chapter of this thesis (see Section 2.4) which discussed how, through active participation in an activity, one learns to become a member of a community of practice (Lave, 1988; Lave & Wenger, 1991; Rogoff, 1990). Connecting such understandings with the work of Gee and other cultural-media, educational theorists, we can begin to see a link between different areas of research, and how connections emerge between understanding of cultural digital practices and their influence on learning.

Returning to the particular learning possibilities that computers and digital technologies create, researchers (Atherton, 2002; Buckingham, 2003; Gee, 2003) have also discussed how technologies allow young people to become, not only consumers, but also the authors and producers of their own texts. Research in this field discusses how technologies (web pages; music software; film-editing software) have led to a revolutionary shift in how we produce cultural artefacts. Through digital technologies and specialised software we now have the capabilities of creating and authoring our own digital productions. In this respect, technology has made a unique contribution to a societal shift in how cultural artefacts and products are created (Buckingham, 2003; Gee, 2003; Sefton-Green, 1999). For example, we no longer wait for the main commercial publishers to distribute new music - bands and individuals, at all levels, now use the internet to sell and advertise their work (O'Hara & Brown, 2006). Due to rapid changes in the size and power of technologies, it is now possible to have a full professional music studio in your home, which can allow young people to create music to a high standard easily.

In sum, over the years there has been a shift away from simply considering how technology complements traditional learning possibilities, to a focus on how it provides unique new opportunities for thinking, interaction, communication, production and consumption. The focus is now on how such computer and digital technologies actually transform how we create, author and produce new modes of expression. This shift of focus is relevant to this thesis. There has been little work carried out on how particular music technologies (keyboards and computers) support or hinder the productive, creative, collaborative process. What work has been carried out is examined in the following section and in the next chapter, Chapter 5.

4.2 Computers in music education

As previously noted, since the early 1980s the availability and application of ICT across the curriculum has influenced all subject areas, although it was not until the 1990s that music technologies were explicitly referred to in the National Curriculum. Today they are prolifically used and music technology has become a recognised subject area in its own right (Salaman, 1997).

Alongside this recognition there has been a slow but growing body of research on the potential of computers and technologies for music education (Folkestad, 1998; Hoffman, 1990; Kratus, 1991; Mellor, 2001; Seddon & O'Neill, 2001; Upitis, 1989; Webster, 1989a). In relation to this thesis, although much of this work has tended to focus on *individual* compositional and creative strategies using music technologies rather than *collaborative* strategies, it has provided valuable insights.

For example, Mellor (2001) has focused on the same computer sampling software (eJay) used within this thesis. eJay is a CD-ROM, which allows your PC to become a mini editing suite. Using pre-programmed samples or samples you have created yourself, you can arrange your composition in the style, for example, of Dance and Hip hop music genres. Mellor examined children's individual compositions using eJay, analysing primary school children's (7-9 years of age, Key Stage 2) compositional and creative-thinking strategies. Mellor found that eJay can assist learners in experimenting and exploring with musical sounds and structures, as well as assisting pupils in attaining their music education targets as set out within the UK National Curriculum.

Folkestad (1998) and Folkestad, Hargreaves, & Lindström (1998) have also examined how computer technologies provide learners with the opportunity to compose in a variety of ways. In particular, Folkestad (1998) identified two compositional styles when working on the computer:

1. Horizontal composition style – refers to how the composer creates the piece from the beginning to end by separating the compositional and arrangement processes. During this process the computer is used in two ways:

   a. As a co-musician – the composition is worked out on an acoustic instrument and then entered into the computer where further editing and arrangement occurs.
   b. Throughout the whole composition and arrangement process – assisting the musician by providing a visual means for working.
2. Vertical composition style – refers to how each section of the piece is completed before moving on to the next section. In this compositional style, the computer is used more as an interactive tool, where the software responses (Folkestad, 1998, p. 120) guide the development of the composition.

Folkestad's work has been pivotal in demonstrating the different ways in which the computer can be used to compose music, and his findings have been particularly useful in practical discussions with teachers on how computer-based composition can add to the music curriculum. Also, by comparing musicians who had formal training with those who had not, Folkestad showed that formally trained individuals tended to produce compositions with more 'fixed ideas' (Folkestad, Hargreaves, & Lindström, 1998). According to Folkestad, this finding could explain how participants with experience of instrumental tuition have different approaches to music making from those who do not, in that they have more fixed ideas about how to arrange the composition.

This had its advantages and disadvantage for both parties, as Folkestad notes:

> ... while instrumental training may be important in the process of realising musical ideas, it can also become an obstacle in the exploration of the options of the equipment. On the other hand, for those who do not

> have any performing skills and thus need all the help that the equipment can provide, exploration of its possibilities becomes a necessity. (Folkestad, 1998 p. 125)

Folkestad's work complements the research conducted by Webster, Yale and Haefner (1988), who also found that formally trained musicians' computer compositions were less original and that they experimented less with the possibilities offered by the computer. Similar conclusions have also been reached by Scripp, Meyaard, & Davidson (1983) and Seddon & O'Neill (2000). For example, Seddon & O'Neill (2000), using a version of the Cubase sequencing software, found that adolescents (aged 13-14 years) with two years' prior experience of instrumental tuition, adhered to musical parameters associated with traditional notions of musical form and structure when composing alone on the computer. Seddon and O'Neill concluded that participants' preconceived ideas and values about music carried over from their training, leading them to explore less the possibilities of the software.

Similarly, although not in relation to computer composition, Rosenbrock (2002), in her extensive study of German rock bands, found that musicians who had some form of formal instrumental tuition were significantly less likely to compose than those who were exclusively self-taught. According to Rosenbrock, this finding may be explained by the difference between what she called 'formal training' and 'self-teaching'. Self-taught musicians predominately learn to play by improvising and playing by ear without sheet music Rosenbrock believed that the high standards often set by formal instrumental lessons discouraged individuals from improvising, particularly because it advocated a reliance on notation (reading and writing music). Consequently, in relation to rock band's compositional processes, similar to the aforementioned computer-based studies, Rosenbrock found that prior musical experiences led to particular and different compositional approaches from the approaches of those who had no formal training.

Finally, in relation to music software it is also necessary to note that the majority of popular music-editing software is based on more traditional, classical approaches to music, which are then transformed into the program by the designer. It is worth exploring how different hardware and software, which is based on more popular approaches to making music, influence how music is constructed. Söderman and Folkestad (2003) have partially examined this in their study about how hip hop musicians, with different approaches to the genre, develop their skills and merge beats with lyrics. They found that the 'beat-makers' merits were in laying down the main beat, and in choosing an appropriate style and choice of backing tracks and samples over which the hip hop collective could layer their lyrics.

The technology used in this form of music making – records, samplers and the turntables – was not based on classical approaches to making music, but utilised popular music equipment. Similarly, Savage and Challis (2002) have pointed out that DJs and other popular musicians' compositional styles have not been fully utilised in teaching how ICT and digital technologies can be used for composing music. Green (1998) has specifically argued that there is a need to further examine the practices of popular and non-formally trained musicians, as the potential ways in which they learn could lead to new approaches to music education. In relation to this thesis, this point is noteworthy as it indicates that our knowledge to date of such music practices is limited. As this thesis attempts to uncover some of this knowledge, the outcomes of this research are relevant to key contemporary debates within the field.

4.3 Discussion and conclusions

To conclude, as one of the key research questions addressed in this thesis was how technology influenced the creative compositional processes, it was necessary to review the work carried out in this area. This chapter specifically examined how computers make a unique contribution to learning, emphasising their ability to support multimodal forms of communication and new forms of interaction. This has been linked with understandings from the field of music education, where research to date has predominantly focused on individual computer-based composition strategies.

Throughout the chapter, emphasis has been placed on how little we understand the contextual features that influence computer-based music and learning experiences. Evidence from general studies on computer-supported learning and music education indicated that a variety of influences from the software design to participants' prior experiences can, and do, affect the learning and creative experience.

Taking this and the previous chapter's concerns into consideration, this further highlighted the need to address how particular aspects of the context, such as the task, the technology, the group interactional processes, and participants' prior training and cultural experiences, are organised and influence the collaborative creative process.

To conclude, this chapter extends the previous review on how particular mediational tools provide the means to express ideas and communicate with others. Given the body of evidence discussed in this chapter, it would seem that particular experiences and educational interventions allow for certain processes to occur while limiting or closing off others.

Within the music educational community, the need to better understand the contexts that support music creativity (in both composition and performance) has widely been acknowledged (Folkestad, 1998; Folkestad, Hargreaves, & Lindström, 1998; Sundin, McPherson, & Folkestad, 1999). Despite this, few researchers have systematically explored the influences that shape this process and there is a dearth of research into the collaborative composition process. From this perspective, the focus on this area in this thesis is both relevant and timely.

5. A review of research on creativity

5.1 Introduction

This final theoretical chapter discusses creativity, explaining how it has been defined within this thesis in relation to both music and digital technologies. Understanding creativity and, in particular, the creative collaborative process was one of the main overarching themes addressed in this thesis. Consequently, the previous research findings presented in this chapter were central to the understandings that emerged.

Defining creativity per se is difficult. 'Who' is creative and 'what' is creative is an amalgamation of societal influences, individuals' talents and cultural processes. Traditionally, research has overemphasised the 'talented' individual and 'novel' product conceptualisation of creativity, which has neglected the social process through which creative products and outcomes emerge. More recently, terms such as 'creative thinking' have become popular, and, although this term is not ideal, it was considered useful and adopted within this thesis. Finally, in reviewing this area, some overlap between research in non-formal learning and creativity was found. Such findings are discussed and their relation to the research undertaken in this thesis is mapped.

5.2 Defining creativity – a historical perspective

Early creativity theorists (Dewey, 1910; Rossman, 1931; Wallas, 1926) considered creativity to be a structured, linear process with identifiable problem-solving stages. Identifiable phases of creativity included, preparation, problem definition and identification, incubation, multiple solution formation, critical evaluation and the formulation of new ideas. Although creativity is no longer conceived in such a linear way, these early models were seminal. Importantly, they highlighted that prior knowledge and experience within a given area (preparation) increased the chances of an individual being more sensitive to the knowledge gaps within a domain area. This, in turn, increased the person's ability to identify new areas of development (problem definition and identification). These characteristics still inform our understanding of creativity. However, the conceptualisation of creativity as a linear process reduced its complexity to a series of step-by-step stages. Additionally, these early models were person-focused, in that creativity was conceived as an internal, individual process. As a result they neglected the potential social and collaborative influences through which creative experiences and products developed.

For some time, between the 1930s and the 1950s (during the Second World War period), creativity was not considered as a major area of research. After the war, interested in the area began to re-emerge. Since then, the concept of creativity as a form of divergent thinking, in comparison with convergent thinking has been popular. Convergent thinking is where the aim is to generate the single, best solution to a problem (Torrance, 1988, 1990). Divergent thinking, on the other hand, refers to the construction of a variety of ideas or solutions (similar to

Rossman's idea of multiple solution formation) to a problem. Operationally, divergent thinking was measured by: 1) *fluency of ideas* – the ability to generate many solutions or ideas; 2) *flexibility* – the ability to change approaches or shift focus; 3) *originality* – the ability to generate unusual or novel solutions, products or ideas (Torrance, 1988, 1990).

In comparison with earlier models of creativity, Guildford, Torrance and colleagues considered creativity as not just a form of problem solving, but rather as a specialist form of *intelligence*. However, in recent years, this notion of cfreativity has come under heavy criticism (Cropley, 2001; Puccio, 1993). At the time it drew too heavily on measures derived from intelligence tests. Like many intelligence tests from this period, the validity, reliability and cultural-social bias of such tests have now been criticised. Despite this, research on creativity as a form of divergent thinking has had a far-reaching legacy. For example, it has influenced Gardner and colleagues' (Gardner & Hatch, 1989; Hatch & Gardner, 1993; Rogoff, Ellis, & Gardner, 1999) seminal work on multiple intelligences, which considered the possibilities that there were a variety of types of intelligence (e.g. spatial, kinaesthetic, verbal) rather than one single, general intelligence. Gardner and colleagues' work and concepts of divergent intelligence have also influenced Webster's (Webster, Yale, & Haefner, 1988; Webster, 1992) work on the creative-thinking process within music, which will be discussed in detail in Section 5.4.

In sum, despite the influence that divergent thinking has had on our general understanding of creativity and intelligence, similar to the older models of creativity (Dewey, Rossman), it still conceptualised creativity as an individualistic phenomenon. Over time, such understandings have led to an overemphasis on definitions of creativity in relation to its outcomes and products, where the main measure of success or value is the production of novel and useful products.

5.2.1 Creativity as open-ended problem finding and discovery

In an attempt to move away from individual-product-driven approaches to creativity, researchers began to reconsider the earlier, problem solving process models of creativity. Csikszentmihályi & Getzels (1970), in their criticism of divergent-thinking models of creativity, noted that they were inherently bound to fail. This was because, in experimental tests, participants were asked to solve tasks defined by the experimenter. In their opinion, such an approach did not deal with the most interesting characteristics of the creative process; namely, the person's ability to define the nature of the problem. Addressing this, Csikszentmihályi & Getzels (1970, 1971, 1973) began to discuss creativity as a problem-solving process, situating it on a continuum between two poles; with presented problems at one end and discovered problems at the other. A presented problem was a clearly formulated problem with a predefined, accepted or agreed-upon solution; while a discovered problem was characterised as a vague, dimly felt, emotional or intellectual tension, where the problem has yet to be defined and where there is no single agreed-upon method for resolving the tension. In such cases, one cannot even imagine what the end solution might become. Complementing Csikszentmihályi & Getzels' problem-solving approach to creativity, Amabile (1985) also considered intellectual tasks on a continuum between what she referred to as 'algorithmic tasks' (that is, tasks where there were no clear or specific methods of solution) and 'heuristic tasks' (that is, tasks in which the problem was vague and yet to be defined, and where there was no agreed-upon method or solution). Importantly, in such circumstances, just because there is no single solution does not mean that there is no end product - but that the product or solution may be one of many possible outcomes. Csikszentmihályi and Getzels (1970) reached a similar conclusion in their definition of the creative process as the 'formation of a problem, adaptation of a method of solution, and the reaching of *solutions'* (p70). From this perspective, the person's ability to define or formulate the nature of the problem, rather than actually solve the problem, is a better index of creativity.

To test their hypothesis, Csikszentmihályi and Getzels (1970, 1973) conducted a series of longitudinal studies on artists' problem-orientation processes. They found a correlation between discovery orientation and problem solving strategies - that is, the ability to explore and define problems by oneself. Their findings showed that exploration and a discovery orientation was a better index of artistic success over time (Csikszentmihályi & Getzels, 1970).

Extending his work, Csikszentmihályi (1988a, 1997) and Csikszentmihályi & LeFevre (1989) began to examine the nuances of peak creative experiences. Csikszentmihályi's notion of 'flow' conceived peak creativity moments as an automatic, effortless, yet highly focused state of consciousness.

Flow experiences extend an individual's capacity, in that they involve an element of novelty or discovery. Csikszentmihályi (1997) identified nine characteristics of such 'flow states', some of which include having a clear goal and, importantly, enjoyment in the activity for its own sake (what he called authotelic activity). In this respect, 'flow states' are peak periods, where all prior experiences and skills combine within one moment, to make new combinations, explorations and transformations.

In this respect, 'flow states' are highly evolved and personal states of consciousness, where problem identification and solution come together in one moment.

In sum, considering the work of Csikszentmihályi & Getzels, Amabile and early creativity theorists (Dewey, 1910; Rossman, 1931; Wallas, 1926), the conclusion is that the creative task and process is by its very nature different from fixed, closed tasks. The creative task and process is an ill-defined, open-ended process, which has no 'correct' or 'final' solution. During peak creative moments of 'flow', an individual is in a particular state or frame of mind, during which they are actively bringing together all their knowledge and resources to create new outcomes. Taking this view of creativity, one of the most interesting characteristics of the process is the person's ability to define the nature of the problem.

5.2.2 Social and environmental influences on creativity

Since the 1980s, creativity research has also begun to consider how communities of practice and the social environment within which creative experience take place, play an important role. Creativity from this perspective has come to be defined as a social, situated practice, where emphasis is placed on how societal, cultural norms and values impact on what we consider creative and whom we consider creative. For example, Leach et al. (2000) discussed how Nobel Prize winners or musicians benefit from their associations with other creative people within their communities, in that they provide a means of support and inspiration. Csikszentmihályi (1988b) also discussed how creativity emerges in virtue of a dialectical process among individuals of talent, domains of knowledge and practice and fields of knowledgeable judges. It is through this dialectical process that, over time, what we consider creative and whom we consider creative are negotiated.

Amabile (1985, 1989; Amabile, Goldfarb, & Brackfield, 1990), in particular, has examined how the 'qualities of environments' - that is, the factors outside of the individual - influence the creative process. Amabile focused on how extrinsic factors, such as evaluation, surveillance, reward, competition and restricted choice, constrain or deter creativity.

Amabile was one of the first to consider systematically how different environmental factors influence the creative process. However, despite her groundbreaking work, her early computational model of creativity still took a very individualistic and product-driven approach to creativity. For example, in her work she considered external judges' opinions on what was the most novel and valuable product or outcome to be her definition of creativity. Consequently, her definition negates the process in favour of product, value-driven models creativity. Nonetheless her work has been widely applied within the commercial and business sectors and it has contributed new understandings of how features in the environment can support or constrain creativity.

In sum, despite the shift from an individualistic to more social notions of creativity, the importance of the product as the core outcome of creativity still dominated. Although some researchers (Csikszentmihályi, 1988c; Leach, Millar, Ryder, & Sere, 2000) have considered the way in which notions of who is creative and what is creative emerge through social, collective processes, this is different from understanding the conditions and process through which group outputs emerge through creative, collaborative practices.

Boden (1990) argues that we need to recognise that what is novel on an individual basis, is and can be very different from what is considered as creative on a societal, historical level. Boden refers to 'psychological creativity' (P-creativity), that is, creativity that is novel for the person or group, but not novel on a historic, social level; while historical creativity (H-creativity) is creativity that leads to social change. Boden argues that both types of creativity are equally important for the individual or social group, in terms of fulfilment, motivation and satisfaction. Craft (2000) similarly recognises the need to distinguish between exceptional creative individuals or groups, who shift paradigms in societies way of knowing, which she refers to as big creativity ('big C') and in comparison individual's potential for self-actualisation, which she refers to as little creativity ('little c'). In considering creativity within educational contexts, Craft calls for more work to be conducted on the ways in which we can support 'little c' in individuals' everyday life. In particular, Craft acknowledges that creativity involves people having agency over their environment and the power to be able to make and act upon choices to be creative and inventive. Creativity from this perspective involves not only being in a relationship with oneself but also with other people and different subject domains.

Interestingly, some of the understandings emerging from such thinking around creativity complement the research conducted on non-formal learning (as discussed in the first theoretical chapter Section 2.4.1). For example, in both areas, divergent-thinking skills are considered a key feature. Additionally, the environmental features that Amabile (1998, 1996, 1990) found hindered creativity, such as evaluation, surveillance and restricted choice, were the very kinds of behaviours that are purposefully avoided in non-formal learning settings (Eraut, 2000; Smith & Jeffs, 1990). In this respect there was some synergy between the descriptors of non-formal learning environments and the kinds of environments considered conducive for creativity. Despite these similarities, it important not to lose sight of the fact that creativity is a very particular kind of endeavour it is a specialised form of problem solving, a state of consciousness, of 'flow', of producing work that is novel, either at an individual level (psychological creativity, Boden, 1990; little c creativity, Craft, 2000) or in some cases at a global level (historical creativity, Boden, 1990; big c creativity, Craft, 2000). The understanding of creativity as 'little c' creativity has influenced recent policy documents on creativity (NCCA, 2000; NFER & commentary, 2000; Williamson & Facer, 2004) on how schools can foster creativity from an early age, enhancing not only an individual's life but potentially supporting people to become more accomplished within their chosen fields. For the most part, these policy documents recognise and advocate the need for enhancing 'creative thinking', considering it as a 'skill' which can and has to be learnt like any other. This is problematic; particularly given that underlying concepts of 'little c' is the notion that its meaning is subjective and individual and therefore may not be reducible to a taught 'skill' level. The question of how to 'teach' creativity is currently hotly debated and outside the scope of this thesis. However, it is anticipated that the research findings reported in this thesis could go some way towards contributing to the field and provide not only new theoretical insights but also practical outcomes for how to support creative experiences within learning contexts.

5.3 Creative thinking using digital technologies

As discussed in the previous theoretical chapter (Chapter 4), many researchers and authors have maintained that digital and ICT tools have transformed how we interact, learn and work (see Section 4.1.1). To recap, due to the unique properties of computers and digital technologies (e.g. their interactive, multimodal and networking capabilities), they have become power tools, which allow us to create, author and produce new modes of literacy. Marrying their capabilities with the growing emphasis within education on creativity, within the last few years an increasing amount of research has been carried out on the role of digital technologies and creativity. Reviewing some of this work, Loveless (2002) notes:

> ... a characteristic of creativity with digital technologies would be the recognition of the potential of the features of ICT to be exploited and experimented with to support the creative processes. Learners and teachers therefore need to have a range of experience in which they can engage, play and become familiar with the distinctive contribution that ICT can make to their creative practice which other media tools do not offer. (Loveless, 2002, p. 12)

Loveless (2002) examines how the specific characteristics of ICT and digital technologies can complement the creative process and support the following:

- *Development of ideas* – this refers how properties of digital tools, such as their interactivity and capacity to represent information in a variety of modes can support creative processes, such as imaginative play, exploration, trying out ideas and approaches to problem solving, taking risks in conjecture and making connections between ideas.
- *Making Connections* – important to creativity is the ability to search and connect knowledge. Digital technologies allow for communication and connections, through the internet and CD-ROM, to a variety of online artefacts, documents and knowledge sources.

- *Creating and Making Meaning* – this refers to how the technology plays a distinctive role in creative activities by providing opportunities to capture, edit and transform digital data in order to make new meanings and representations.
- *Collaboration* – this refers to the speed and range of ICT and digital technologies and how they enable learners to collaborate with others in immediate and dynamic ways during their creative progress; for example, through email, video editing, internet.
- *Communication, Publication and Audience* – this relates to how technologies enable learners to present their works using a range of mediums, from PowerPoint presentations to websites, to real-time online streaming.

While Loveless's (2002) summary is useful, it is only a guide and does not specifically explore the nuances of how digital technologies contribute to creative processes. Acknowledging this, Loveless reports that overall there has been little systematic work carried out in this area, and what research has been conducted has been sporadic, with conflicting results.

For example, Ritchie and Edwards (1996) evaluated the effects of a general thinking-skills computer program, de Bono's CoRT (Cognitive Research Trust), in enhancing creative thinking in Aboriginal children's educational and scholastic aptitude. Their results revealed that the CoRT program could enhance creative thinking, but not the children's general scholastic aptitude, which was defined as their school achievement, thinking approach, self-concept as a thinker and intrinsic motivation and self-control. The reasons for this seemed, in part, due to issues of implementation and the lack of emphasis placed on divergent thinking skills throughout the curriculum. They believed that a curriculum which enhances more divergent thinking skills might encourage greater educational progress in Aboriginal children. This view has also been expressed by Mevarech & Kramarski (1992), who demonstrated that Logo could improve creative problem-solving skills and students' interpersonal relationships. Their results showed that students who participated in Logo environments scored higher on several aspects of creativity (figurative-originality, verbal-flexibility and verbal-originality), as measured by the Torrance Test of Creative Thinking (Torrance, 1974), than students who were exposed to either Guided-Logo or a non-treatment control group. However, as Mevarech & Kramarski note, 'children in school are not required to solve problems creatively, nor are they provided with tools for facilitating creativity' (1992, p. 273).

Other researchers investigating Logo-based environments have also reported its benefits in enhancing creative problem-solving skills (Clements, 1991; Lehrer, Randle & Scancilio, 1989). Clements showed that children working on Logo-based collaborative problem-solving environments gained higher scores on measures of originality than children who worked collaboratively on a word processor, and in comparison with a control group who worked collaboratively using no computers. In addition, Lehrer et al. (1989) found that children working on Logo in small groups, compared with children not working on Logo, were better able to apply what they had learned in new situations.

These studies highlight the potential some computer software can have for enhancing creative thinking and its potential educational value. These findings go some way towards supporting Loveless's (2002) list of characteristic ways in which ICT can be utilised to develop creative thinking.

However, although the aforementioned studies have indicated how computers can enhance certain aspects of creativity, the outcomes of this body of work have again been concerned with measuring the outputs of computer-supported creativity in relation to school attainment targets, as opposed to exploring how computers influenced the creative process or added their own unique value *per se*.

Also, these studies have been carried out predominantly in Logo programming environments, which have been criticised by many researchers for their lack of flexibility, emphasis on maths, and dependence on an intensive and highly structured curriculum, aimed at fostering fixed problem solving (Hoyles & Sutherland, 1989; Pea, 1985; Pea & Hawkins, 1987). Consequently, one could argue that the design of such a program is not the best tool to use if studying the open-ended nature of creativity.

In more recent years, Sharples (1993, 1994, 1997) has written extensively on the benefits of computer-based collaborative writing. Sharples has focused, in particular, on the creative-writing process using computers and how computer use can afford, constrain and mediate the writing process. Sharpies (1996, 1998) views writers as 'creative designers', emphasising the writer as a *user of tools*, such as the computer hardware and word-processor software, and as a *creator of cognitive artefacts*. Sharples (1998) also considers the new possibilities opened up by the digitisation of text and electronic writing. Apart from writing for the Web, this involves the possibilities of hypertext fiction, writing in MOOs (Multi-Object-Oriented, Multi-User Domains) and voice-recognition software as possible further spurs to creativity. Sharples work complements the sociocultural understandings discussed previously in this thesis (see Chapter 2), where humans are considered as meaning makers, who appropriate and use psychological and physical tools to create new modes of expression (Rogoff & Lave, 1984; Wells, 1986).

According to Sharples (1996), creativity in writing occurs through a cyclical process of engagement and reflection, which is guided by various constraints and possibilities. In discussing the creative writing cycle, Sharples found that what kick-starts the processes is the need for 'knowledge telling'; this is similar to 'brainstorming', where ideas are generated and written down for consideration. This period is often followed by reflection and reviewing the material. Reflection and contemplation in turn generates new ideas, which are explored and transformed, producing plans and constraints that drive a further period of joint writing. Vass (2002) has also noted similar cyclic phases in her study on the role of computers in collaborative creative writing, and the impact of friendship partners on this process. Vass found that joint computer use was beneficial for the collaborative restructuring or reshaping of the composed texts and facilitated shared creative thinking.

In conclusion, when considering how ICT can facilitate creative thinking and collaboration, it is necessary to move beyond the application of tools for their own sake and the simple measuring of individual outcomes. This requires examining how ICT can become the means through which representations of meaning are constructed, and the processes that this entails. As discussed in the preceding chapter (Section 4.1.1), this involves examining in detail how ICT can support creative thinking and multimodality; that is, the manipulation of various multimedia, such as words, sounds and images, to create and make meaning. However, music is a particular, specialised form of meaning making, and therefore it is necessary to consider what particular creative processes are engaged in when working within this domain. In addressing this, we can better understand the marriage between the creative collaborative process and music technology.

5.4 Creative thinking and music

Within music education, there have been two main threads of research, which address creativity that are relevant to this thesis: 1) definitions of creative thinking within music; and 2) research on the creative processes that are engaged in when making music.

5.4.1 Definitions of creative thinking within music

In relation to music education, contemporary definitions of creativity also consider it as a thinking style. For example, in the English National Curriculum for Music, creativity is considered as a thinking skill within which young people can analyse, evaluate, adopt and develop music ideas (DfEE, 1999, p. 9). Within this, creativity is discussed generally in relation to improvising and composing, and seldom in relation to performance or listening. Consequently, there are gaps in our knowledge. For the purposes of this thesis, the creative composition process is focused upon.

In attempting to create an encompassing model and definition of creativity for music, Webster (1989, 1992) has combined aspects of nearly all the models previously discussed. Although this has benefits in that it covers all areas from individual-product-driven, to social-process oriented models, 'catch-all' models also have their limits. For example, in using them to create intervention strategies, it often happens that aspects of the model are refined and so its encompassing vision tends to be lost.

In attempting to distill all previous perspectives of creativity into one, Webster has concluded that the term 'creative thinking' is actually more appropriate than just 'creativity' per se. He defines creative thinking within music as:

> A mental process that has individuals think with sound, make aesthetic decisions about these sounds, and produce a product that can be evaluated by themselves and others. (Webster, 2001, p.1)

According to Webster, creative thinking in music is a dynamic mental process, alternating between divergent (imaginative) and convergent (factual) thinking, which moves in stages over time. It is enabled by internal musical skills and outside conditions and results in a final musical product which is new for the creator (Webster, 2001). Webster's model acknowledges how aspects of both convergent thinking (where there is only one solution) and divergent thinking (multiple solutions) are necessary in music making. This definition is useful as it moves away from conceiving the creative process as a linear process and also acknowledges how environmental relations influence the process. Webster's notion of creative thinking within music has been used as a starting point within this thesis, as it draws attention to the need to consider the critical, factual and open-ended processes that are at play when creating music.

5.4.2 The creative process when making music

Many researchers (Byrne & Sheridan, 2003; DeLorenzo, 1989; Folkestad, Hargreaves, & Lindström, 1998; Webster, 2001) have considered what kinds of creative-thinking processes are involved when making music. As noted in Section 5.4.1, Webster (1989, 1990a, 1990b) has been at the forefront of research on creativity and music and his work has influenced how many music researchers discuss creativity within music. Building on Csikszentmihályi's (1997) work and on the early problem-solving models of creativity (Dewey, 1910; Rossman, 1931; Wallas, 1926), Byrne and colleagues (Byrne, MacDonald, & Carlton, 2003; Byrne & Sheridan, 2003) have begun to use these approaches as diagnostic and assessment tools for music teachers. Byrne and colleagues' goal was to create a teaching tool which allowed teachers to recognise creative moments within the classroom and how to best optimise them, particularly when working with music technologies (Byrne, 2003). In this respect, their approach has a very practical implication for teaching and supporting creativity within the classroom.

DeLorenzo (1989), in his work on music problem solving, emphasised the importance the student places on their own creative processes and products, as it provides the motivating force that drives the student to seek further information and develop new skills and expertise. According to McPherson (1998; p.143), DeLorenzo's study provides evidence of the need for students to experience ways of thinking about music and working with music in various contexts.

For DeLorenzo (1989), creative thinking within music does not solely depend on maturation or practical experience, but also on conscious decision making and familiarity with the material. According to DeLorenzo, these processes involve, in part, the active manipulation of the sound material and the 'conscious recognition of choices that contribute to the expressive nature of the resulting product' (DeLorenzo, 1989, p. 5).

Specifically, DeLorenzo (1989) examined young people's different musical strategies, distinguishing between what he called 'highly involved' and 'lowly involved' problem solvers. Highly involved problem solvers:

> ... worked with a limited set of sound events and explored these events at greater depth and breath ... the student worked systematically with a particular music motif by revising, adjusting, or elaborating the motif's structure one step at a time. Forward motion, in the creative process, was guided by the logic of the evolving musical structure. The student engaged in continuous aural evaluation and appeared to have some sense of knowing what to do, even though the problem solution remained a fuzzy conception until the end of the creative process ... this student [*the highly involved]* actively directed the course of the musical exploration and shaping process. In this regard, his/her creative production reflected a strong interplay between cognition, aural history, and the physical presence of sound. (DeLorenzo, 1989, p. 165)

In contrast, lowly involved problem solvers:

> ... produced sound after sound, not sure what they wanted, where they were going, or what they might do when they found it. Sound-making became a physical activity rather than a purposeful search for potential musical material ... It appeared that these students had not yet developed the cognitive structures for thinking in sound, and did not possess a sufficient repertoire of musical images from which to

make sense of new aural data. (DeLorenzo, 1989, p. 164-5)

From these extracts, highly involved problem solvers would seem to engage in a more constrained creative way, carefully selecting a limited number of samples, which were critically and aurally appraised. In contrast, DeLorenzo found that lowly involved problem solvers had not developed the same critical musical faculties and so engaged with the music in a much more spontaneous and visceral way. Relating DeLorenzo work back to the previous chapter (Section 4.2) on the computer-based music compositional strategies (Folkestad, 1998; Folkestad, Hargreaves, & Lindström, 1998; Seddon & O'Neill, 2001b; Webster, Yale, & Haefner, 1988), it would seem that highly involved problem solvers appear to share some of the characteristic qualities of formally trained instrumental musicians' working processes on computers.

For example, Seddon and O'Neill (2001) and Webster et al. (1988) found that young people with formal music training worked with a limited set of sounds and did not explore functions or play with what it had to offer. However, it could be argued that there are advantages and disadvantages to both 'high' and 'low' approaches to music making. For example, 'high' approaches could better suit certain types of music composition or contexts and more 'low', visceral approaches better suit others. Although there has not been much work carried out in this area, it is worth exploring in more depth, and hopefully some of the findings from this thesis will shed some light on the questions.

5.5 Discussion and conclusions

In sum, the aim of this final theoretical chapter was to review the research that had been carried out on creativity and, in particular, creativity in relation to digital technology and music. As noted, the early problem-solving models of creativity still continue to impact on contemporary ideas of creative thinking. Initially, creativity was defined in relation to the person and product; now the creative process is considered to be at least as important as the final outcome. Importantly, there has been an increasing recognition of the importance of social and cultural influences on creativity, which has led to creativity being considered as a dialectical and collaborative process among individuals of talent, with various domains of knowledge and practices working in the context of fields of knowledgeable judges. From this background, researchers working in the field of digital technology and music have discussed the kinds of creative processes engaged in when working with such tools, and how they might afford certain modes of expression and ways of thinking.

Although research on creativity may at first appear quite separate from the previous discussions on sociocultural theory, it has been argued that these two areas could and should be brought closer together. If we aim to create more flexible, life-long, self-directed approaches to learning, then we need to better understand how open-ended tasks, as epitomised by creative tasks (such as music composition), actually work. We also need to better understand the relationship between formal and non-formal learning settings and the types of interactions that emerge spontaneously within such settings. This will hopefully lead to better designed, more inclusive and useful educational resources. Digital technologies play a central role as they can facilitate new learning opportunities, across different settings.

Considering the overarching areas and agenda, this thesis attempts to contribute to the field specifically by exploring the collaborative and creative processes when young people make music together, using various technologies, in different settings. It is anticipated that the main outcomes of this thesis will be a greater understanding of these forms of creativity and a better understanding of the contextual relations that influence creativity. The following chapter recapitulates the main theoretical chapters and their relation to the research questions addressed in this thesis. How these questions are to be explored specifically in each of the following empirical chapters is also summarised.

6. Research questions

6.1 Summary of theoretical chapters

As outlined in the previous theoretical chapters (Chapters 2-5), the vast majority of research on school-based collaboration has, to date, been concerned with scientific and mathematical problem solving, where the task is fixed and often only has one 'final' correct solution. However, there is sufficient evidence to suggest that the very nature of creative, open-ended tasks differs from 'closed' tasks, as the emphasis is less on finding problem solutions and more on problem finding, exploration and discovery. Relating this to creativity and music, there is a clear need to explore this, as much of the work carried out has tended to focus on individual rather than collaborative creativity, and has emphasised the importance of the creative product over the process.

To address this multidimensional and complex problem, research from the fields of sociocultural and situated-learning theory, cross-cultural studies, non-formal learning, digital technologies, collaboration and creativity theory grounded the explorations carried out in this thesis. Chapter 2, 3 and 4 discussed the core tenets of sociocultural theory, emphasising the essential mutuality between the individual and their context and the role of dialogue and technology in mediating and supporting thinking and communication. These chapters influenced the methodological approach taken in the thesis, as it was believed that, through analysis of participant verbal dialogues, one could gain insight into how participants created a meaningful context, as they collaborated and composed music together in different settings.

A central precept in comprehending context from this perspective was to understand how meaning was embedded and called upon, in what was defined as 'formal', 'semi-formal' and 'non-formal' settings. Specifically this thesis was interested in exploring what aspects of the context, that is what constitutional relations or features of the setting, participants invoked when composing together using keyboard- and computer-based music technologies. To assist this, Chapter 5 outlined how creativity and creative thinking has been examined and defined by different theorists particularly in relation to music and technology. Overall this chapter lead to a more informed understanding of the creative process in learning, music and digital technology.

In sum, as noted in the closing arguments of the previous chapter (Chapter 5), if we continue to disregard the possibilities of exploring the connections between collaboration, creativity and music technologies, we lose out on the potential each one has to address imbalances in our knowledge and understanding of the other. This thesis aims to explore these links specifically through the analysis of young people's collaborative and creative processes when working together using music technologies in different settings.

6.2 Main research questions

To address this area, the following questions were asked:

1. What kinds of verbal dialogues do young people engage in when working around keyboards and eJay sampling software in formal and non-formal settings?
2. What are the collaborative creative processes young people engage in when making music together using keyboards and eJay software in the above settings?

3. How do different aspects of the context (e.g. task setting and instruction; technology; teacher; prior musical and cultural experiences) influence the collaborative creative process?

To address these overarching questions specifically, a series of studies were carried out in a variety of different formal and non-formal settings. Within each study, particular nuances of the setting were examined for how they influenced the participants' shared meanings and understandings of the task. It was also clear that in order to begin to work in this area it was necessary to understand how music technologies were currently applied within formal school settings. The following is a summary of the main subject matter of each of the empirical chapters.

6.3 Summary of the empirical chapters

Chapter 7 – Study 1 *Survey of secondary school music teachers' perceptions and application of music technology*. This chapter discusses the results of the survey, focusing, in particular, on the kinds of technologies most commonly used and how they were applied.

Chapter 8 – *Methodological framework*. The chapter outlines the methodology, rationale and approach taken to analysing the participants' verbal dialogue using a coding scheme specifically designed for this thesis.

Chapter 9 – Study 2 *An exploration into young people's creative, collaborative compositions using keyboards in a semi-formal school setting.* The results of the survey of music teachers showed that keyboards were the most commonly used music technology within secondary school. This chapter explored the kinds of dialogues the young people engaged in when making music together using keyboards. Specifically, the study examined the influence of the task instruction on young people's music creative music-making, during lunchtime school music sessions.

Chapter 10 – Study 3 *An exploration into young people's creative, collaborative compositions using* eJay *during formal school music lessons.* The teacher survey also indicated that computers were commonly used for music within secondary schools, and that sampling software, such as eJay, was popular. Building on the findings from Chapter 9, this chapter focused on authentic classroom situations, examining young people's interactions when making music using eJay in a typical classroom setting. The contextual relations focused on how the young people used the computer software to make music and how the task instruction influenced the process.

Chapter 11 – Study 4 *An exploration into young people's creative, collaborative compositions using* eJay *in a non-formal setting (a Girls' Brigade band in a community centre).* Moving away from school settings, this chapter investigated the kinds of talk and creative processes engaged in by young people when working in community centres using eJay. Specific focus was on how participants' wider cultural references, such as television, influenced their creative processes.

Chapter 12 – Study 5 *An exploration into young people's creative, collaborative compositions using* eJay *in non-formal, music camp setting.* Continuing the exploration of non-formal learning settings, this chapter specifically examined how young people's prior musical experiences influenced their collaborative and creative interactions when working together in Girls' Brigade band and music camp settings.

In sum, the empirical studies build on each other, with each chapter adding to our knowledge of how different features of the setting (i.e. the dialogues engaged in; task instruction; software used, etc.), influenced the creative collaborative process. The following chapter reports on the first of these studies, which summarises secondary school music teachers' perceptions and uses of music technologies.

7. Survey of secondary school music teachers' perceptions and applications of music technologies

7.1 Introduction

As noted in the opening theoretical chapters, there is a dearth of work carried out on the collaborative, creative processes engaged in when working with music technologies. To begin to address this, the current chapter presents the results of a music technology survey designed for and administered to music teachers in England and Wales. The rationale for carrying out this survey was to gain a greater understanding about the kinds of music technologies used within secondary schools, at the time of the study (2000-2001), and teachers' perceptions of them. In this respect, this study functioned as a foundation for the remaining empirical studies in the thesis, providing an overview of music technology practices within UK secondary schools.

7.1.1 The application of music technology within secondary education

Music technologies (keyboards, computers) were first introduced into UK secondary school classroom during the early 1980s. Since then there has been a steady growth in the availability of ICT across the curriculum, reflecting the aim that ICT would support more individual and self-directed forms of learning. However, it was not until the 1990s that music technologies were explicitly referred to in the National

Curriculum for England and Wales. Although they are currently advocated at all key stages, it is not until Key Stage 3 that music technologies are specifically referred to as a means 'to explore, create and record sound' (National Curriculum Orders for Music Education, quoted in Rogers, 1997). This recommendation complements the compositional targets at this key stage, as pupils are expected to compose a piece of music in a variety of styles, with texture, pitch and duration, the idea being that music technologies support pupils in attaining these targets. However, little work has been conducted within the area, particularly on whether ICT does indeed support these goals.

Nonetheless, despite advocating the use of music technologies within the curriculum, only very few studies have discussed their relevance within the music curriculum (Busen-Smith, 1999; Mills & Murray, 2000; Pitts & Kwami, 2002). For example, Busen-Smith (1999) has examined the implication for teacher training of teaching music via technologies, making the distinction between teaching music and teaching technology. Her findings reported that postgraduate secondary education students' main concerns regarding ICT use within music were to do with musicality rather than technology. Student teachers found it difficult to monitor how the compositional processes were developed using ICT, or how best to integrate it with other musical skills without discouraging acoustic and group work. Other concerns regarded equipment failure, their own lack of knowledge, and whether ICT really added to the pupil's musical experiences. On a more positive note, the student teachers did consider that technology could afford compositional opportunities that other musical instruments could not provide. For example, music technologies allowed for easy layering of different instrumental or compositional parts and multi-track editing. In addition, music technologies had the potential to encourage new ways of thinking about music; in particular, the students believed that it could foster more critical compositional editing skills.

Busen-Smith's findings on student teachers perceptions of ICT within music is reiterated in Mills and Murray's (2000) survey of professional teachers' application of ICT to promote music learning. Mills and Murray's study was the first large and comprehensive study conducted within the UK on the application of ICT within secondary education. They specifically focused on Key Stage 3 (11-14 years); the stage, as previously noted, where music technologies are first introduced in the curriculum as a specific tool to create music. Their findings examined 'good' and 'bad' characteristics of music technology practices, drawing on one- and two-day observations and discussions with key teachers during visits by the inspectors from the Office for Standards in Education (Ofsted) in 52 English schools. To summarise their findings, 'good' music technology practice was characterised by clear planning and organisation, a positive teacher attitude, and an environment in which both the musical and creative aspects of music technologies were highlighted. 'Bad' music technology practice was seen where classroom environments lacked any planning or imagination, where no meaningful connection was made between the music technology practice and other music terminologies or customs. Other limitations observed by the inspectors were due to the size of the groups (if the group is too big not everyone can contribute) and the frustrations experienced with technical breakdowns.

In a more recent study, Pitts and Kwami (2002) carried out a more detailed but smaller survey (18 schools were involved) than Mills and Murray's, on teachers' and pupils' use and perceptions of ICT as a compositional resource. They also focused on Key Stage 3, asking teachers to give details of the tasks, methods and factors they considered important in teaching composition through ICT. The teachers were also asked to provide information on hardware, software, technical support and their use of the internet as a resource. Further investigations, such as structured interviews with the students (11-17 years) and teachers as well as observations of the software used, were conducted within 8 of the 18 schools. Pitts and Kwami's findings indicated that Busen-Smith's student teachers' concerns and Mills and Murray's observations regarding the pitfalls of bad ICT practice were well-founded. Lack of experience, training and resources, as well as the cost of running and maintaining the systems, were the main concerns and problems teacher experienced and expressed. Pitts and Kwami found that teachers played multiple roles in music technology lessons - as technicians, directors, listeners and facilitators - with the majority of pupils' queries related to technical aspects of the activity, particularly breakdowns. They found that, in some schools, teachers sometimes spent a third of the time on such activities. In terms of the methods used by teachers, Pitts and Kwami found that teachers used a variety of learning frameworks, from highly structured to open-ended processes, which were carried out in a mixture of whole class, group and paired pupil situations.

Pitts and Kwami (2002) found that the most common type of equipment used were keyboards and PC computers, with the majority of schools using sequencing packages, such as Cubase, Logic or Cakewalk, and less than a half using notation packages, such as Sibeluis. CD ROMs were generally used as a source of reference, with two schools using them as means of deriving pre-recorded samples. Recording equipment, such as minidisks linked to the computers, was most common, with pupils' use of the internet during class time being minimal.

Teachers mostly used the internet as a resource at home or during holidays to download samples and sounds. In general, music technologies were most commonly used to support composition, with Cubase being applied at both Key Stages 3 and 4. Pitts and Kwami found that students were generally eager to hear what they were doing and get it right, with some highly motivated students working during break times. Some pupils did feel that there was less immediacy with music technologies and that they did not connect with the music theory lessons, while students who could read conventional notation seemed to prefer 'score edit' functions on software such as Sibelius, rather than the more abstract sound manipulations that could be carried out using sequencers and Cubase.

In sum, the Busen-Smith, Mills and Murray, and Pitts and Kwami studies together build a picture of the application and merits of using technologies within music education. Busen-Smith's study focused predominantly on student teachers' concerns, perceptions and initial experiences of using music technologies. The aim of Busen-Smith's work was to address the issue of music technologies within teacher training rather than its application within authentic classroom settings. The student teachers' concerns and experiences were echoed in Mills and Murray's large-scale survey of music technology practices in school settings. This survey, which was a general exercise, aimed at reporting to stakeholder groups (government, teachers and practitioners) what constituted 'good' and 'bad' use of ICT within authentic classroom situations. Mills and Murray's work provided a guide or set of recommendations for teachers and practitioners on the productive and unproductive use of music ICT for learning. Although the study provided a seminal overview of the area, due to its scale, the report lacked details on the actual kinds of music technologies used and the contexts within which they were applied. In particular, as the survey was based predominantly on inspectors' observations it may not reflect all teachers' experiences. Addressing this, Pitts and Kwami's smaller-scale, more detailed case-study approach provided a more in-depth, qualitative view of individual teachers' experiences and importantly also addressed pupils' perceptions of music technologies, an area which none of the other studies had previously addressed in any great detail. Pitts and Kwami were particularly concerned with the application of music technologies to composition and the methods and factors that influenced this.

7.2 Research aims

The study reported here builds on the aforementioned research by extending our understanding of how music technologies were applied in secondary schools. The survey does not attempt to compare and contrast music technologies. The intention was to provide an overall impression of the kinds of music technologies that are used, focusing on the social application of such technologies and teachers' personal accounts of using ICT within music.

7.3 Method

7.3.1 Setting and participants

The study consisted of 121 randomly selected professional music teachers from secondary schools in England and Wales. Over half the music teachers taught school Years 7-11, while the remainder taught Years 7-13. The areas represented in this survey span local educational authorities (LEAs) across the west and east midlands, southwest and northern parts of England, Greater London and Cardiff, Wales. Approximately 800 questionnaires were administered, with 121 returned. Although this may appear to be a low response rate it is fairly common for 'cold call' questionnaire surveys to receive a 15% response rate. Table 7:1 is a percentage breakdown of the regions where the responses came from:

Table 7:1: Overview of the questionnaire distribution

Area	**Percentage**
The Greater London region	17
Birmingham	14
Sheffield	9
York	5
Cardiff	5
Liverpool	4
Rural areas and towns	46

In sum, 54% of responses came from major cities, while 46% came from rural areas and smaller towns across England and Wales. Although inner city schools were represented slightly more than rural areas, the spread was representative of urban and rural areas across the UK and Wales.

From the questionnaires received, 94% of the teachers replied that they do use music technology in the classroom; this was not a surprise as it was part of the music National Curriculum for England and Wales.

7.3.2 Task and analysis

The music teachers were sent a questionnaire (see Appendix 2) devised by the researcher. Participants had to either answer 'yes' or 'no' to questions, circle an appropriate response from a range provided or write free responses and comments in answer to other questions. In *Section A* of the questionnaire, background information such as, age, type of school and gender was collected, this information was not analysed in this study, and collected only for future reference.

To capture the teachers' applications of music technologies and the contexts in which they used them, a four-part questionnaire (Sections B-E) was designed. *Sections B and C* focussed on asking what music technologies the teachers used and the social context within which the technologies were applied. The social context referred to whether the technologies were employed with individuals or groups and the make-up of any groups. *Section D* focussed on the teachers' perspectives on the effectiveness of music technology. Within Sections B, C and D, respondents had a choice of answers from which they could circle the most appropriate response. In *Section E* respondents could circle 'yes' or 'no' responses and write their comments to questions about their views on how pupils' reacted to the use of ICT within music. Teachers also had the opportunity to add any further comments if they wished.

A covering letter (see Appendix 3) was sent with each questionnaire, guaranteeing participants' anonymity and assuring them that their responses would only be used in the context of this research. The data from the questionnaire was entered into SPSS 10, a statistics package, where the percentage frequencies of responses were calculated.

7.4 Results

7.4.1 The types of hardware and software used and the social context of their application

One of the main difficulties encountered with analysing the types of music technologies used by this population was the difference and variety in what teachers defined as music technology. Based on the previous literature within the area, teachers were asked specifically whether they had hardware such as keyboards, computers and sequencers, and software such as Cubase and Sibelius, and how often they used them.

From this, keyboards and computers were found to be the most frequently used music technologies (95% of teachers used keyboards either all or some of the time; 83% used computers either all or some of the time). Cubase[2], a sequencing and editing package, was the most popularly used software. The least used was the Sibelius[3] notation package; although some teachers did comment that they used Sibelius themselves to prepare work, and some more advanced pupils used it for homework assignments.

In contrast to these specific questions, teachers were provided with a blank space which they could fill in, to indicate whether they used any extra equipment to supplement their practice. This yielded an array of responses about various software, recording and drum equipment. In

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2 http://www.steinberg.net/
3 http://www.sibelius.com/cgi-bin/home/home.pl

these responses, Logic[4] sequencing software, recording equipment and other sequencing and compositional software such as Cakewalk[5] and eJay[6] were mentioned.

Table 7:2 Other forms of music technologies used within the classroom

Other forms of music technologies	**Percentage**
No other music technologies used (besides keyboards, computers, sequencers, Cubase and Sibelius)	33
Micrologic or Logic (sequencing package similar to Cubase)	11.6
Multi-track recording, mixing desk, sound processing	17.4
Cakewalk (sequencing software, 5.5%) or eJay (sampling composition software, 5%)	10.7
CD-ROMS	5.8
Amps, tapes, minidisks	2.5
Drum machines, audio recording	2.5
Other (various recording equipment, software, internet, PlayStation, etc.)	14.8
Missing responses	1.7

In general, teachers found that music technologies were most applicable at Key Stages 3 and 4 (11-16 years). Within the sample, approximately 82% of teachers used music technologies in groups either some or all of the time. Pairs and mixed-ability groups were the most common. Groups tended to be self-selecting, with pupils choosing whom they would like to work with on the day.

[4] http://www.emagic.de/EN/index.html
[5] http://www.cakewalk.com/
[6] http://www.ejay.co.uk/home/default.asp

7.4.2 The effectiveness of music technology, its advantages and disadvantages

The questionnaire responses and written comments indicated that teachers considered the application of ICT within music positively, in that it provided them with an effective tool with which to teach, support and motivate learners. Quotations from the teachers' written comments are used to support this (below). The quotations selected were taken from the teachers' responses to the areas in which they found music technologies most applicable (Section D in the questionnaire) and their written comments (Section E in the questionnaire). From their comments, specific themes relating to the teachers' concerns and opinions about music technologies were identified, such as: the use of music technologies as compositional tools; financial and resource issues; limitation of music technologies; technical difficulties and training issues. These themes emerged through periods of re-reading, summarising, identifying and clustering recurring key points within the questionnaire responses. In the following sections, all quotations taken from the teachers' questionnaires use their own words, grammar, abbreviations and emphasis. The quotations are given as exemplars of the aforementioned themes.

7.4.2.1 Music technologies as compositional tools

Teachers responded that music technologies were most useful for teaching composing. Not all teachers noted what kinds of technologies best supported composition. However, it would seem that sequencing and editing packages such as Sibelius, Cubase, Cakewalk, eMagic and Logic, were the most popular. This is supported by Teacher 55's comment (see Teacher Quote 1):

Teacher Quote 1: Teacher 55, referring to the use of specific computer packages for composing, arranging and recording

> ... I am a recent 'convert' to the use of Sibelius for arranging and composing. Sequencing [i.e. sequencing software] such as Cubase, eMagic, Cakewalk etc is useful for composing, arranging and recording especially at GCSE level.... [*referring to General Certificate of Secondary Education*]

And

Teacher Quote 2: Teacher 20, referring to the use of specific hardware for composition and recording supplement pupils work

> ... I am able to allow some GSCE students to use the studio (computers, sequencers, keyboards) to work on compositions and produce recordings...
> ... They [*pupils*] find the sounds are realistic and they can control them ...

From these comments, we can identity that the teachers considered music technologies to be most useful for certain components of the composition process, such as 'arranging' music (see Teacher Quote 1) and producing 'realistic' sounds that were easy to 'control' (see Teacher Quote 2). In the following quotations, other teachers also noted that music technologies allow pupils to 'hear multiple components' simultaneously and efficiency, save time and allows pupils to record and store their work easily (Teacher Quote 3 and Teacher Quote 4).

Teacher Quote 3: Teacher 13, referring to the use of the computer and sequencer

> They find it [*computer*] a useful medium to save time and particularly enjoy hearing multiple parts when composing using a sequencer.

Teacher Quote 4: Teacher 15, referring to how music technologies are useful for saving work

> .... can easily save work in their file to be worked on each week.

Some teachers also noted that the use of software such as Sibelius helped with scoring pieces and that CD-ROMS assisted with general music understanding as they provided an alternative means for learning about theory and other styles of music. None of the teachers mentioned using music technologies to support instrumental performance. This finding highlights that teachers have not yet fully considered the potential of music technologies to be used as a performance tool and that the dominant role consigned to them within the classroom has been as a compositional, recording and storage tool.

7.4.2.2 Advantages and disadvantages - financial issues

Overall, from the teachers' responses, their interpretations of pupils' reactions to the use of music technologies were positive, with over 86% of the teachers replying that their pupils enjoyed using music technologies. When asked what they considered as the main disadvantages of using music technologies the teachers reported that the financial cost of purchasing and maintaining equipment, recurring breakdowns, lack of resources, lack of skills, and inadequate training were their main problems. This finding was supported by the teacher's written comments (see Teacher Quote 5), particularly how frustrated they were at the costs of purchasing equipment and 'begging' for resources (see Teacher Quote 6).

Teacher Quote 5: Teacher 54 referring to financial disadvantages associated with the application

> Computer technologies still take little notice of music. Purchase of up-to-date PCs still have to have extra spent on them to adapt to music, e.g. expensive sound cards to take midi inputs. Prices are reducing but software licenses still are very prohibitive in cost and drain resource, e.g. Sibelius system at 350[7] plus for one piece of software! Over 2/3 of the cost is for the user license – ridiculous!

Teacher Quote 6: Teacher 66 referring to financial disadvantages associated with the application

> We do not have enough money to buy the technology. I have 2 Atari CLAB Notate and they don't work. We are a very small 11-16 school and funding for this seem to come only from 'institutional begging' to outside agencies.

[7] Quote given in GBP in 2000

7.4.2.3 Technical limitations and information needs

Some teachers also called into question the quality and appropriateness of using keyboards in classrooms (seenTeacher Quote 7) and the time it takes to 'set up' (see Teacher Quote 8) equipment and address breakdowns, which resulted in not using music technologies as much as they would like to. Other teachers (see Teacher Quote 9) provided examples of the frustration at having too few resources and inadequate access to new software and information. In particular, teachers note how they learn about new equipment via other teachers in the area.

Teacher Quote 7: Teacher 8 referring to equipment and support limitations

> Lack of technical support for the teacher. Keyboards designed for home use, don't really stand up to the wear and tear of daily classroom use.

Teacher Quote 8: Teacher 15 referring to equipment and support limitations

> It takes too long to set up; there are equipment problems, with the result that I have done very little with them these years. [*i.e. with the use of the computer room and teaching music technology*].

Teacher Quote 9: Teacher 4, referring to problems of access and information about music technology programmes

> In all the catalogues in my department, there is not a single one with any computer software included (*researchers note – referring to music software*). This will mean my computer (when it comes! - *teachers own emphasis used)* will have only the programmes that I can manage to find from asking other music teachers in the area.

7.4.2.4 Design issues

Other teachers' written comments reflected their problems with how music technologies were designed without thinking about how they are used within educational and classroom contexts (see Teacher Quote 10) or the needs of musicians and the importance of creating more tactile and responsive interfaces (see Teacher Quote 11). These comments reflect in part the problems with using software (for example, such as Cubase, Sibelius) that is designed for professional contexts, but, when used in educational situations, is found to be not appropriately designed for learning. Consequently, the following teachers' comments highlight the urgent need to address how music technologies are designed and implemented in school settings.

Teacher Quote 10: Teacher 6, referring to limitations in creativity and design of music technologies

> Computer software is generally unimaginative and uncreative, written by computer specialists rather than musicians. The new Roland keyboards, designed for classroom use, are welcome, but why so unfriendly in their sequencing capacity?

Teacher Quote 11: Teacher 11, referring to the limitations of the design of music technologies

> Not very tactile (expect a mouse and keyboard!). Doesn't encourage sensitivity, touch, and feel as acoustic, percussive instruments.

7.4.2.5 Training needs

Regarding the type of training received, Table 7:3 shows that 75% of teachers had received some form of training, but this varied from a few hours, to one or more days, via LEA, inservice training (INSET) and music industry courses, to full university and collage diplomas and degrees. Interestingly, 6% of teachers were self-taught, highlighting not only the inconsistencies and variations in standards that existed but also that the kind and amount of training received often depended on teachers' interest in the subject.

Table 7:3: Source of teachers training in using music technologies

Source of training	**Percentage**
Professional ourses (LEA, INSET, industry, in-school, diploma, degree)	35.1
Workshops	26.5
PGCE	13.7
Self-taught and professional courses	11.1
Self-taught	6
PGCE and self-taught	3.74
No training	0.9
Missing responses	3.3

Teachers' written comments also expressed their views about their insecurities in using and delivering music technologies and the 'embarrassment' (see Teacher Quote 12) this can cause, and their frustrations and own lack of training (see Teacher Quote 13).

Teacher Quote 12: Teacher 67, Referring to teacher insecurities in using music technologies

> Pace of technological development has led to being unsure, lack of knowledge and embarrassment. Pupils can access the technology better than the teacher.

Teacher Quote 13: Teacher 73, referring to lack of training and resources

> I got very frustrated with using technology and having to use it; a) because I am not trained and b) we are under resourced.

In addressing the issues of knowledge and training, some teachers called for more specialist assistance in using music technologies within music (see Teacher Quote 14).

Teacher Quote 14: Teacher 35, referring to the need for more specialist help

> We need much more specialist help in ICT for musicians, for example, keyboard techniques, MP3, sequencers and sound processing.

Based on this, it would seem that there is a need not only to address the financial needs of teachers but also a need for technical 'specialist' support to assist teachers when breakdowns occur, installing new software and sorting out which software and equipment is best for use within classroom contexts.

However, despite the frustrations reflected in the teachers' comments on the need for more training and information on music technologies, there was evidence that teachers were interested and wanted to become more informed about music technology themselves (see Teacher Quote 15).

Teacher Quote 15: Teacher 28, referring to interest in knowing more about using music technologies music education

> I am very interested in this area – any strategies or suggestions for developing and improving the use of IT in music/music technology, courses offered etc please let me know.

7.4.2.6 Lack of 'real' musical skills

Other disadvantages mentioned by the teachers in their written comments concerned the loss of 'real' musical skills, such as rhythm, singing and listening, when using music technologies (see Teacher Quote 16 and 17).

Teacher Quote 16: Teacher 33 referring to the loss of musical skill when using music technologies

> It is a tool and mustn't be used to the detriment of teaching other musical skills, singing/rhythm/listening and working together etc.

Teacher Quote 17: Teacher 58 referring to the loss of musical skill when using music technologies

> At the moment I perceive that the ICT requirement is inflicted upon music without real regard to the musicality of the outcome. I refuse to comply with this until I can guarantee a system where ICT serves music in a 'musical' way.

However, in both these comments, it is unclear what specific music tools they felt were detrimental to these skills. Teacher 33 emphasised that music technologies should be viewed as one of many 'tools', rather than the only tool which can be used within music education. Teacher 58, taking a more sceptical and apprehensive view of music technologies, referred to how they have been 'inflicted' on music education, and 'refused' to comply until there had been evidence that they serve music education in a 'musical' way. These comments mirror how some teachers were extremely cautious about the application of music technologies and their appropriateness within music education.

7.4.2.7 Motivational benefits of music technologies

Despite these limitations, many teachers' comments noted the motivational benefits of using music technologies, particularly in motivating young boys (see Teacher Quote 18) and the enjoyments pupils get out of listening to their compositions (see Teacher Quotes 19 and 20).

Teacher Quote 18: Teacher 18 referring to the motivational aspect of music technologies

> They [pupils] respond very well. It has been a particularly useful tool in motivating boys.

Teacher Quote 19: Teacher 21 referring to the motivational aspect of music technologies

> They love hearing themselves. They have ICT skills, which transfer readily to music application. Good way of involving boys, though it is important that it should not be a 'boys only thing.

Teacher Quote 20: Teacher 4, referring to accessibility and development

> Programmes such as Dance eJay is very accessible to Year 9 pupils. Key stages 5 have opted to study music technology and have a great love of the subject.

In addition, other teachers commented on how sampling and arranging software such as Dance eJay was very accessible to specific age ranges (Year 9, Key Stage 3), and how pupils at Key Stage 5 had a 'great love' for the subject (see Teacher Quote 20), while Teacher 21 noted how the ICT skills developed in other subject areas can be used within music classes (see Teacher Quote 19). Thus, despite the many of the misgivings teachers had, they also acknowledged the motivational aspects and cross-curricula technical skills that can be developed when using music technologies, as well as how in some cases music technologies encouraged pupils to engage with and develop a 'love' of music more generally.

7.5 Discussion and conclusions

In sum, this chapter reported on the work carried out on the role of music technologies within education. The aim of the chapter was to provide a foundational basis for the investigations carried out in this thesis. In particular, the study focused on the social application of such technologies and teachers' personal accounts of their use of music technologies. The following is a brief summary of the main findings.

7.5.1 The social application of music technologies

The current study complements previous work carried out in the area, much of which had examined teachers' perceptions and practices using music technologies within secondary-school settings (Busen-Smith, 1999; Mills & Murray, 2000; Pitts & Kwami, 2002). Complementing this body of work, the current findings indicated that keyboards and computers were the most frequently used forms of music technologies. For this reason, the remaining empirical chapters presented in this thesis focus on these technologies.

Additionally, the current study established that the most common social use of music technologies was in group settings, particularly dyads, and not individual contexts. This finding is extremely relevant to the following studies reported in this thesis, which specifically explored the social, collaborative nature of music composition in both school and outside school settings. As previously noted, little is known about how groups collaborate or the processes they engage in when working on music technologies. The main questions addressed in this thesis deal precisely with this by exploring, in formal and non-formal settings, young people's creative collaborations using music technologies.

7.5.2 Music technologies as compositional tools

Keyboards were found to be the most commonly used of music technologies, and they were found to be used mostly for composition. However, from the survey it was not clear why keyboards dominated, particularly as there was a lack of understanding about the actual compositional process partners engaged in when working collaboratively around the keyboard. To address this issue, the first empirical study to be presented in this thesis (in Chapter 9), specifically addresses the role of keyboards within the creative, collaborative compositional process. In doing so, the outcomes directly address a gap in our current understandings in this area.

The survey findings also indicated that computers were also used for composition. In particular, sequencing and editing software, such as Cubase, Logic and Cakewalk and notation packages such as Sibelius, were the most frequently used programs. From this it would seem that the computer is one of the most important tools in supporting composition-based tasks. However, as noted in the opening theoretical chapters, in relation to group music composition processes in schools, there is a dearth of work addressing the kinds of processes and skills supported by these tools. This issue is specifically addressed in Chapter 10, where pupils' creative and collaborative process when using the computer-based sampling software eJay is examined.

In conclusion, the findings from the teachers' survey contribute to the growing body of literature in the area of music technology practices in English and Welsh secondary schools. Importantly, the survey highlighted that, despite the proliferation and use of music technologies (especially keyboards and computers), little is known about the actual processes engaged in when working with these tools/instruments. This thesis specifically addresses this question by examining how young people compose collaboratively using keyboards and computers in both formal (see Chapters 9 and 10) and non-formal settings (see Chapters 11 and 12).

8. Methodological framework

8.1 Introduction

This chapter functions as a bridge, outlining in detail the methodology used to analyse the data and the coding scheme developed and applied throughout this thesis.

As noted in the chapter on collaborative dialogue (Chapter 3), analysis of participants' verbal dialogues is one of the most common ways to examine collaboration. It was considered that this approach could be used as a productive means to explore the kinds of interactions young people engage in when working on creative collaborative music tasks and, in particular, to shed light on the kinds of knowledge participants drew on to co-construct shared meaning.

8.2 Rationale: using verbal coding schemes within art- and music-based collaborations

There is a dearth of research addressing the nature of collaborative creative work in arts- and music-based tasks. Consequently, there was no 'off-the-shelf' coding scheme that was specifically developed to analyse such tasks.

Miell and MacDonald's (2000) work on music and friendship, used elements of Berkowitz & Gibbs (1983) and Kruger's (1993) notions of transactive and non-transactive communication. They focused on the musical motifs that the young people used while collaborating using *traditional* musical instruments and not computer or digital instruments. As far as I am aware, their dialogical-music scheme is the only one that specifically attempts to examine both musical and verbal transacts. However, due to the exploratory nature of the research conducted within this thesis, its emphasis on the situated nature of learning, and the lack of any coding schemes that specifically focused on music technologies, it was decided to develop a scheme which addressed specifically the types of interactions examined in this thesis. This chapter describes the process of development and the meaning of the coding scheme used in this thesis.

8.3 Process and aims of the coding scheme

The aim of the coding scheme was to extract a deeper level of understanding of the processes that young people engaged in when making music together in different settings.

It was decided to locate the analytical framework within contemporary sociocultural and collaborative research that combined both quantitative and qualitative dialogical approaches to learning (see Chapter 3 for a detailed discussion). This was related to the research that was carried out on cross-cultural education, formal and non-formal learning, music education and creativity.

This theoretical matrix was considered most appropriate as it complemented the complex layers of verbal and non-verbal dialogues that occurred simultaneously during the music technology tasks examined in this thesis. Although the coding scheme focused specifically on the verbal dialogues, it also included notes on non-verbal action, such as pointing, laughing, gesturing and observational notes on behaviours such as who had control of the mouse. These notes on non-verbal actions were used to supplement the understanding of the verbal dialogues.

In taking into account both the verbal and non-verbal communication process, it was anticipated that this approach would shed light on the verbal creative and collaborative interactions and the supporting non-verbal communication that young people engaged in when composing music using keyboard and computer-based technologies.

It is important to note that there are limitations to using coding schemes; they are descriptive and so by their very nature can obscure some aspects of the interaction (Rourke, Anderson, Garrison, & Archer, 2001; Wegerif & Mercer, 1997). Accordingly, the coding scheme was used at the preliminary stage of the analysis, on the basis of which further interpretations at a more qualitative level were made. In this respect the quantitative analysis was a springboard from which further richer interpretations at the social, temporal and dynamic level were made. This two-tier approach was considered the most useful way to gain a deeper understanding of the nature of musical technology collaborations examined in this thesis.

To achieve this, coding techniques commonly used by researchers within collaborative learning, such as functional analysis and approaches to knowledge construction (De Laat & Lally, 2003; Veldhuis-Diermanse, 2002), were drawn on. For example, functional analysis focuses on the communicative strategies used by an individual while interacting with others (De Laat & Lally, 2003; Halliday & Hasan, 1989). It is closely linked with the topic and domain being worked on and the individual expectations and evolving interpretations of the situation that are shaped by the sociocultural context of the activity (Kumpulainen &

Mutanen, 1999). The identification of the language functions is therefore based on their use and implication in the task setting and not on their linguistic or grammatical form. Similarly, knowledge construction process as used by De Laat and colleagues (De Laat & Lally, 2003) focuses on the meanings generated within a particular context, rather than on the syntactic boundaries which are based on the linguistic or grammatical boundaries of the language. Although it may be easier to use syntactic boundaries to segment the dialogues, according to Chi (1997) and Ericsson & Simon (1984) it is more meaningful to use semantic boundaries. These semantic boundaries were identified by the researcher after a period of continuous reading and interpretation. Observational notes taken during the actual recordings of the tasks and during the transcription were used to supplement the decision on where to place semantic boundaries.

In sum, the initial phase of the coding process consisted of the following:

1. *Dividing the transcripts into meaningful units (Cresswell, 1998)*

   An utterance was considered as the minimum and most meaningful unit of analysis. Each utterance was defined in terms of its source, purpose and situated conversational meaning. Following on from the aforementioned approaches to coding dialogues, the boundaries between each utterance were based on semantic boundaries as noted by the researcher.
2. *Assigning a code to each unit*

   Once the units were segmented, the coder assigned each part a corresponding code from the coding scheme.
3. *Entering the data into the software*

   Once the above steps were completed, the data were entered into the software used in this thesis. Using the software, the proportion of each code as a total of all the participants' utterances was calculated. This information provided the basic descriptive statistical information for each data set.

Within each of the following empirical chapters, a more detailed account of the methodology (setting, task, participants, procedure and analysis) followed in each study is provided.

In order to achieve consistency across the settings explored in this thesis, a set of coding rules were established (see Appendix 4).

8.4 Designing a or the coding scheme

According to Chi (1997), creating the codes and their associated meaning is the most difficult step in analysing dialogue. The main challenge was then to capture the complex processes at play, within a coherent framework, without reducing or simplifying them. Drawing on Chi's practical discussion about how to develop coding schemes, various readings of the data were conducted, field notes were taken, and cross-references made to other research in the area (as discussed in Section 3.2). From this body of work, the labelling and meanings associated with each code emerged.

8.4.1 Deciding on the meaning of individual codes

The coding scheme was subdivided into three levels (for an overview of each code and its shorthand descriptor, see Table 8.1):

1. *Content oriented talk*: This included all talk related to the thinking activities participants use to attain their goals, such as exploring, planning, informing, evaluating and experimenting types of talk (Chi, 1997; Kumpulainen & Mutanen, 1999, 2000; Mercer, 1995; Scardamalia & Bereiter, 1992; Van Boxtel, 2000; Veldhuis-Diermanse, 2002; Vermunt & Verloop, 1999). Depending on the form they took, content-oriented types of talk were subdivided into ten types of talk (as outlined and described in the following Section 8.4.1.1).
2. *Affective talk*: Affective talk can be compared to regulative types of talk; that is, the types of talk that participants use to express their feelings of support or dissatisfaction during the learning process. The definitions for affective questions and answer type utterances were similar to the definitions used by other researchers (De Laat & Lally, 2002; Kaartinen & Kumpulainen, 2001; Kumpulainen & Mutanen, 1999, 2000; Van Boxtel, 2000; Veldhuis-Diermanse, 2002). Affective types of talk were subdivided into seven different types of talk (as decribed in the following Section 8.4.1.2).
3. *Miscellaneous:* All talk that was untranscribable, in that its meaning was too difficult to decipher, was coded as miscellaneous.

In approaching the coding of the dialogue in this way, the aim was to extract the cognitive, metacognitive and social process that occurred between individuals. The theoretical basis for these categories of talk, as outlined in the opening theoretical chapters (see Chapters 2–5), was grounded in the work carried out on situated-learning research (Brown, Collins, & Duguid, 1989; Lave, 1988); cross-cultural educational practice (Cole, 1991; Cole & Griffin, 1987); and Vygotsky's research on the zone of proximal development (Vygotsky, 1978, 1988).

Table 8.1: Coding Scheme

Content Code	
Code	***Description***
S1 Musical Suggestions	The first introduction of new musical ideas related to the selection, arrangement and editing of composition.
S2 Technological Suggestions	The first introduction of new ideas regarding functions and manipulation of the technology, such as, listening, playing, saving, recording or programming the sample and effects bank.
i1 Descriptive Suggestions	The first introduction of new ideas based on descriptions of the quality of sounds.
i2 Cultural Suggestions	The first introduction of new ideas based on wider cultural experiences – such as from, television, film, pop charts and so forth.
E1a Musical Extensions	Utterances that extended musical suggestions (S1) and built on the first introduction of new musical ideas.
E1b Descriptive Extensions	Utterances that extended descriptive suggestions (i1) and built on the first introduction of descriptions of the quality of sounds.
E1c Cultural Extensions	Utterances that extended cultural suggestions (i2) and built on the first introduction of references made to wider cultural experiences.
E2	Utterances that extended technological suggestions (S2) and

Technological Extensions	built on the first introduction of new ideas on technological functions.
Q Questions	Utterances that began with question words and utterances that were question phrases.
A Answers	Utterances that are direct answers to direct questions (Q) and did not provide any further detailed information.

Affective Code	
Code	***Description***
H Humour	Non-verbal communication such as laughter and verbal such as jokes.
P Personal	Talk that was not related to the task; for example, about exams, personal lives.
SUP Non-verbal support	Non-verbal support such as 'ums', 'ahs', and so forth. Also included when participants hum and sing.
SUP1 Agreement	Utterances that expressed participant's agreement.
SUP2 Disagreement	Utterances that expressed participant's disagreement.
EM1 Positive emotive support	Utterances that expressed participant's positive emotive reactions.
EM2 Negative emotive	Utterances that expressed negative emotive reactions.

Miscellaneous	
Category of talk	***Description***
XXX and XXX XXX	Miscellaneous utterances, which were not clear enough to transcribe. XXX referred to miscellaneous words, XXX XXX referred to miscellaneous sentences.

8.4.1.1 Content-oriented Talk

Suggestion categories of talk

Suggestion codes were divided into four types, each referring to a different way of introducing a new idea or thought that had not been previously mentioned in the discussions. They were sub-classified into musical (S1), technological (S2), descriptive (i1), and cultural (i2) suggestions. To further distinguish between the meanings behind these types of suggestions, musical (S1) and technological (S2) were considered as more 'concrete' suggestions, denoted by the letter 'S', while descriptive and cultural suggestions were more 'imaginative' or 'abstract' types of suggestions, denoted by the prefix 'i' (lower case so as not to cause confusion with the number one [1]).

Musical suggestions (S1) were types of talk that introduced new ideas about the composition process; for example, new ideas about the selection, arrangement or editing of samples or the compositional structure.

Technological suggestions (S2) referred to new ideas regarding the technical and functional aspects of the task. For example, they referred to the first time that participants suggested activities such as listening, saving or recording the composition, or to activities such as programming the keyboard's sample or effects bank. Technology-based suggestions referred to utterances regarding the physical manipulation of the technology as well as functional activities such as listening to and replaying the composition.

Descriptive suggestions (i1) referred to new descriptions about how a sample or compositional section sounded. For example, 'that sounds like a toilet flushing' makes the link between the sounds of water in a flushing toilet and that of the pre-recorded sample. Descriptive utterances tried to convey ideas about the quality of the sound or composition.

Cultural suggestions (i2) were utterances, which made reference to the participants' wider musical and cultural experiences; for example, references made to books, films, television programmes and so forth.

Both descriptive and cultural suggestions were seen as new ideas or points of reference in the dialogues, which were distinguished from the more concrete functional musical and technological suggestions.

In sum, these different forms of suggestions represented different ways of introducing new ideas and so served as indicators of the beginning of a new line of thought and work. Suggestion types of talk were then developed in various ways by either extension or affective codes.

Extension categories of talk

Extension categories of talk were related to a corresponding suggestion. This meant that musical suggestions (S1) were extended by musical extensions (E1a); technological suggestions (S2) were extended by technological extensions (E2); descriptive suggestions (i1) were extended by descriptive extensions (E1b); and cultural suggestions (i2) were extended by cultural extensions (E1c). Extensions were important categories of talk to analyse as they allowed for the examination of how ideas developed. An utterance was counted as an extension if it built on what had been previously suggested.

Question and answer categories of talk

Questions were types of talk used by the participants to request and gain clarification about the collaborative or musical process. A distinction was made between direct short answers to questions, which functioned to acknowledge the question, such as 'yes', 'no', 'I know' or 'I don't know', and responses to questions which were more detailed and informative, which were seen as types of extension (either musical, technological, descriptive or cultural extension depending on the function and meaning of the utterance).

8.4.1.2 Affective categories of talk

Affective types of talk expressed participants feelings of support or dissatisfaction. Affective codes included: humour (H); personal (P); supportive non-verbal (SUP); agreements (SUP1); disagreements (SUP2); emotive positive (EM1); and emotive negative (EM2). Humour

(H) referred to jokes and humorous utterances. Personal utterances (P) referred to personal anecdotes about the participants' everyday lives, such as exams, what they were going to eat or buy at lunchtime. It did not include personal cultural references that the participants drew on and which were directly related to the task; such talks were included under the appropriate category (i.e. either i2 cultural suggestions, or E1c, cultural extensions).

Supportive talk was divided into three kinds. Non-verbal support (SUP) included forms of supporting communication such as 'mmms', 'ahhs'. It also included musical communication such as when participants sang or hummed a tune. Although the latter could also be seen as a separate code, as it did not occur so often it was included within this type of talk. Agreement (SUP1) referred to general positive procedural support, such as, 'yeah', 'cool', 'do that', and 'I agree'. Disagreement (SUP2), such as 'don't', 'no', 'nah', referred to disagreements made in relation to the procedures being undertaken.

Emotive support was divided into positive (EM1) and negative (EM2) support. Positive emotive support codes (EM1) were assigned to utterances that expressed a positive, emotive feeling and reaction to how the composition sounded; for example, 'I like this' or 'this is wicked' would have been classed as positive emotive support. Negative emotive codes (EM1) were assigned to utterances expressing negative feelings and reactions about how the composition sounded, such as 'I hate this, this is awful'. Such negative emotive comments were different from disagreements in that they expressed a stronger, more emotive reaction to how the composition sounded rather than just a simple disagreement expressed with a 'no' reaction.

8.4.1.3 Miscellaneous

This category included all utterances (words, XXX; and sentences, XXX XXX) which were not spoken clearly and could not be transcribed.

8.5 Summary of the data collection, transcription and analysis process

8.5.1 Collecting the data

Within each of the following empirical studies (Chapters 9-12), young people's keyboard and computer interactions were captured using a video recorder. Within each setting the camera was set up prior to the young people entering the room.

The camera was always placed on a tripod and pointed towards the group (dyad or triad) and the keyboard or computer. The researcher stood away from this set-up and only occasionally checked the camera for its position and recording. The aim within each setting was to capture the activity as naturalistically as possible and with minimal interference. The researcher also took observational notes during all the sessions. These notes included impressions on how the individuals articulated particular phrases of talk and moved or used non-verbal communication to articulate ideas. The notes were later used to supplement the meanings derived from the coding scheme.

8.5.2 Transcribing and analysing the data

In each of the studies, the same system of transcription and analysis was used. For all studies, each of the interactions was transcribed and coded using the coding scheme described in the above section (8.4). Transcripts included all talk and observational notes on relevant non-verbal action, such as pointing, laughing, gesturing and on what keyboard controls (volume, saving, etc.) were being operated, what the general mood was like, and so forth. Once transcripts were coded, data were entered into a verbal analysis software tool, Multiple Episodic Protocol Analysis, MEPA[8] (Version 4.8). MEPA software provided a structure for entering and storing the data in a transcribed form, which enabled descriptive and frequency analysis to be carried out.

Other advantages of this software were that it allowed for partial automation of the coding process, with increased speed of coding and the facility to search, re-code and interrogate the coded data. The outcomes of the descriptive and frequency analysis were then entered into an Excel 2002 for Office XP spreadsheet and analysis program, and into SPSS 10, where further descriptive statistical analysis was carried out.

[8] MEPA, Multiple Episodic Protocol Analysis developed by Gijsbert Erkens, (G.Erkens@fss.uu.nl) at the Department of Educational Sciences, University of Utrecht, The Netherlands.

8.5.2.1 Analysis of the data

For each study, a two-pronged approach to the data analysis was taken.

1. **Quantitative analysis**

Once the codes had been entered into MEPA and SPSS, descriptive statistical analysis revealed which types of talk occurred more frequently within each setting. The most frequent types of talk were based on the percentage portion of each type of talk spoken across all the groups (dyads and triads). This was calculated by adding up the total amount of each type of talk spoken within each dyad and representing this as a percentage of the total amount of talk spoken by all dyads together. Analysis of these results provides an indication of the pattern of talk emerging from each context.

2. **Qualitative, interpretative analysis**

The aim of the interpretative analysis was to address the more temporal and social aspects of the collaborations and the dyad's creative processes. This was achieved by using the categories of talk developed in the coding scheme as a departure point from which further qualitative, interpretative accounts of the participants' collaborative and creative processes were examined. This analysis departed in some way from the functional analysis of the dyads' utterances and focused more on their moment-by-moment interactions.

The aims of the interpretative analysis were to go beyond the primary, descriptive statistical analysis of the coding scheme and examine more closely how the types of talk were invoked. This interpretative level of analysis examined sequences or extracts of the most frequently occurring types of talk, exploring in particular what was invoked during the participants' moment-to-moment interactions. In this respect, the interpretative analysis went beyond the quantitative analysis by addressing the more social, collaborative and creative dynamic engaged in by the participants.

9. An exploration into young people's creative, collaborative compositions using keyboards in a formal school setting

9.1 Introduction

Within the field of music education, some educators (Odam, 2000) have reported that teachers are concerned that pupils only experience composition in group settings. While Pitts and Kwami (2002) argue that group composition can potentially create a situation where individuals can compose better quality pieces, both references highlight the lack of knowledge about group compositional processes and their benefits for musical learning. The current study addresses this issue, by exploring young people's collaborative compositional processes, while using keyboards in a school setting.

The rationale for exploring keyboard-based compositions was informed by the findings of the previously reported survey (see Chapter 7), where secondary school teachers cited keyboards as the most commonly applied classroom-based music technology. In addition, working in dyads or pairs was the most common way of organising keyboard-based work. This resulted in the decision to examine group-based keyboard compositions and in particular to explore how the young people created a meaningful context, which allowed them to create and collaborate together.

To examine this, the young people's verbal dialogues were examined as it was considered that this would provide insight into their interactional process and also shed light on the kinds of verbal dialogues young people engage in when working on a musical task.

9.1.1 Research on keyboards within schools

In this study, sequenced keyboards were used. These are one of the most advanced type of keyboards used in schools, as they have various preset features such as metronomes, rhythmic backings, 'automatic' harmony and demonstration sequences, which vary depending on whether the keys are 'full size', like a piano, or more touch sensitive. The school in which the current study took place had their keyboards connected like a language lab, where a master keyboard, which the teacher controls, is attached to several other keyboards. This allows for whole-class teaching and provides the teacher with the option to key in to the whole group or to individual keyboards. From a US perspective, one of the primary advantages often cited in favour of keyboards in general, and particularly in relation to the keyboard lab, is that they allow teachers to control and conduct lessons more easily (Appell, 1993; Walczyk, 1991). These authors also note that keyboards can add substance to vocally based curricula, improve musical literacy and foster pride in both students and parents (Walczyk, 1991); while Appell (1993) considers them as important tools for enhancing music curriculum activities as well as the learner's experience, creativity, experimentation, abstract thinking and motivation. Although this evidence is positive, much of it is anecdotal or case-based and no systematic studies have been carried out in the area.

From a UK perspective, Salaman's (1997) critique of keyboards draws attention to how little research has been conducted on the use of keyboards in schools. Salaman is highly critical of keyboard lab-style environments within schools, believing that they lead to prescriptive teaching and assessment and to teachers regarding playing the keyboard as an end in itself (Salaman, 1997, p. 146). According to Salaman, keyboards have become neat and effective tools for assessment in listening, performing and composing skills, and researchers and educators need to address and question their application in music education.

Salaman advocates that we should try to understand why we are using keyboards, what their advantage is for music education, and in particular what opportunities and kinds of musical expression they offer. It is anticipated that the outcomes of this study will go some way to addressing Salaman's concerns.

9.1.2 The learning setting – the influence of the task instruction

As noted in Chapter 3, research on collaborative learning has paid a lot of attention to the nature of the task instruction in science- and maths-based tasks, (Ainsworth, Wood, & O'Malley, 1998; Howe, 1998; Karasavvidis, Pieters, & Plomp, 2000; Van Boxtel, 2000). This research has focused predominately on well-defined tasks; that is, tasks where there already is a fixed or predefined solution.

Although Van Boxtel (2000) has called for further investigations into a wider range of collaborative task domains, within the literature there has been little research conducted on open-ended, creative tasks, where there is no one 'correct solution'. As noted in Section 5.3, some initial work has been carried out in other domains, such as programming graphic environments (Mevarech & Kramarski, 1992) and creative writing (Sharples, 1994; Vass, 2002). However, little is known about the influence of the task instructions when working creatively using music technologies. The influence of the task instructions is the second core theme explored within this chapter.

9.2 Research question

The current study addresses the following question: What kinds of dialogue were the young people engaged in when working together using keyboards on typical structured and unstructured tasks in a formal school setting?

9.3 Method

9.3.1 Setting

The study was carried out in the main school music room, which for the most part consisted of 16 Yamaha PSR 630 sequenced keyboards, connected together via a master controls desk.

The sessions were conducted weekly, during lunchtime, with only the researcher and teacher present, whilst the dyads worked. In this respect, although the study was carried out in a formal school setting, it did not occur during lessons but during the young people's lunchtime.

The teacher was present during all the sessions. This was due to school rules, which stated that no students could be left unattended in classrooms during break times without supervision from a member of staff. The teacher and the researcher sat away from the participants on the opposite side of the classroom. The aim was to capture each dyad's working process on the task with as little interference as possible. Only on three occasions did the teacher and/or researcher become directly involved in the participants' work, twice to solve technical problems and once to answer a question about the name of a note.

The school in which the study was carried out was co-educational with pupils aged between 12 and 19 years. Task 1, a non-structured instruction task was conducted first, and Task 2, a structured instruction task was conducted second. There was approximately four months between each study, due to the teacher and class availability. Order effects were considered before carrying out the study. However, these could not easily be controlled because of the constraints involved in working within a school environment and the teacher's schedule. Consequently, as this effect would confound any formal comparison, the two tasks setting are considered as separate explorations.

9.3.2 Task design

9.3.2.1a Non-structured task instruction

In Task 1, the teacher provided the task instruction, which was "to compose a tune as you wish" using the keyboard. This kind of instruction was familiar to the participants as they often had a period called 'free time' at the end of their normal music lessons. Free time was the teacher's term for a period of time for 'free play' or improvisation on the keyboards. The average task time in Task 1 was 18 minutes.

9.3.2.1b Structured task instruction

In Task 2, the teacher also provided the task instruction, which was to compose a short tune on the keyboard, using sequences labelled A, B, C and D. These sections were then to be arranged in the following order, ABACADA. (This ABACADA pattern was based on the musical form ritornello[9]). The structured task instruction focused on how participants constructed the ABACADA musical sequence. However, aspects of this task were open-ended as they were free to choose the sounds and compositional make-up of each section. Each dyad also received a sheet of paper (see Appendix 5) that the teacher prepared on which the participants had to fill in their ABACADA arrangement. Such task requirements would have been familiar to the participants, as they were often used during their regular music lessons. However, this task was not one they had done in their current school year. The average task time in Task 2 was 16 minutes.

In both task situations, the time spent composing was shorter than the participants' normal school lesson, which generally lasted 40 minutes. However, during lessons participants would have been accustomed to composing single pieces in the amount of time taken by the experimental task.

[9] Ritornello is a form of musical structure, which has its roots in the Baroque genres of the concerto and opera, where melodic and harmonic materials return again and again in the course of the movement. An example of a ritornello is Vivaldi's *Four Seasons*.

9.3.3 Participants

Before the sessions were carried out, letters outlining the study (see Appendix 6) and when it was taking place were sent to the teacher and principal of the school. As the researcher was not allowed access to individual participants' addresses, the music teacher forwarded a letter outlining the study to participants' parents. Within the letter, parents were asked to inform the teacher if they objected to their children being involved in the research. Once consent was confirmed, the teacher arranged for the chosen dyads to come to the music room during their lunchtime. The researcher therefore had no control on the final selection of participants.

When pupils entered the classroom during lunchtime, the teacher introduced the researcher and explained again to the pupils the aims of the research. The researcher explained that participation in the study was voluntary and that they were able to change their mind about being involved in the study and withdraw at any point should they want to. At this point, any pupils who did not want to take part in the study were given the opportunity do to withdraw. No participants chose to do so.

In Tasks 1 and 2, the same nine dyads (18 participants in total, 10 male, 8 female, mean age 14.06 years) worked together. The dyads were drawn from school years 9 and 10 and knew each other, being already friends, acquaintances or regular classroom partners. However, as the researcher had no control over the selection of participants, there was overlap and age differences within one particular partnership. Participant R1 participated in two dyads (R1+R2 and R1+A).

In partnership R1+A there was an age difference of 1.5 years; also, partnership R1+R2 were the youngest pair (both were in school Year 9, while all other participants were in Year 10). Due to this and the potential order effects, it was decided to adopt a qualitative, exploratory approach that focused on how partners in each task setting created a meaningful understanding of the task and on the kinds of creative and collaborative processes they engaged in.

9.3.4 Procedure

During the task, the participants' interactions were recorded on video. The video recorder was placed on a tripod and pointed towards the dyad and their keyboard. The researcher stood away from the keyboard and camera and only occasionally checked the camera for its position and recording. The aim was to capture the keyboard activity as naturalistically as possible and with minimal interference. The researcher also took observational notes during the session.

It is important to note here that the prevailing classroom culture in this school was to wear headphones when working on the keyboard. When carrying out this study, all participants immediately put on the headphones, despite being the only people working in the classroom. At the time of collecting the data, although this issue was considered, its potential influence was not fully understood. However, when analysing the data it became clear that the headphone set-up may have influenced the quality of the dialogues.

In sum, although this is not considered in any detail in this study, in interpreting the data one has to bear in mind that everyday practices that the young people were used to performing while working on the keyboard had an influence on the way they engaged with the task.

9.3.5 Analysis of verbal dialogues

All participants talk was transcribed and entered into MEPA and SPSS software packages (see Section 8.5.2 for details of this software), where the analysis was completed using the coding scheme developed for this thesis (see Section 8.4.1 and Appendix 7 for a shorthand guide to the coding scheme).

9.4 Results

9.4.1 Quantitative analysis – descriptive statistics

This section presents the results of the descriptive statistics performed on the data. Table 9:1 and Table 9:2 show the standard deviation (that is, the spread or dispersion of the scores) for the non-structured and structured tasks respectively.

The tables show that in both setting musical suggestions (S1); musical extensions (E1a); questions (Q); and positive support/agreement (SUP1) were frequently occurring categories of talk. These figures were based on the percentage portion of each type of talk spoken across all the dyads. This was calculated by adding up the total amount of each type of talk spoken within each dyad and representing this as a percentage of the total amount of talk spoken by all dyads together.

Table 9:1 Keyboard: school, non-structured task setting: categories of talk

Descriptive Statistics based on percentage of categories of talk (n= 9 dyads)

Code	Minimum	Maximum	Mean	Std. Deviation
S1	6.10	15.52	9.95	3.94
S2	1.61	10.34	4.85	2.85
i1	.00	7.26	2.4	2.45
i2	.00	3.52	1.21	1.16
E1a	3.45	25.00	12.08	6.06
E1b	.00	4.03	1.8	1.38
E1c	.00	1.61	.40	.65
E2	.00	22.56	7.7	7.19
Q	4.88	16.90	11.14	3.64
ANS	.00	5.00	1.9	1.77
H	.00	2.39	.41	.8
P	.00	21.95	4.91	6.88
SUP	2.42	9.76	6.53	2.41
SUP1	4.88	24.65	14.62	5.81
SUP2	.00	11.67	6.22	3.17
EM1	.00	3.33	1.95	1.23
EM2	.00	6.61	2.06	2.55
MISCELL	1.86	21.95	9.77	7.2

Table 9:2: Keyboard: school, structured task setting: Categories of talk

Descriptive Statistics based on percentages of categories of talk (n= 9 dyads)

Code	Minimum	Maximum	Mean	Std. Deviation
S1	3.57	15.71	8.06	3.36
S2	.00	8.57	4.50	2.76
I1	.00	3.14	.80	1.1
I2	.00	1.79	.24	.59
E1a	7.95	41.23	23.15	11.07
E1b	.00	5.66	.71	1.87

E1c	.00	.75	8.333	.25
E2	.00	17.05	4.19	5.28
Q	7.91	23.27	13.67	5.44
ANS	1.12	7.55	3.17	2.00
H	.00	2.27	.49	.98
P	.00	5.68	1.18	1.82
SUP	1.43	16.07	5.22	4.53
SUP1	10.23	28.77	19.58	5.61
SUP2	.00	9.95	5.08	3.53
EM1	.00	5.19	1.85	1.83
EM2	.00	8.57	1.2	2.86
MISCELL	2.84	13.64	6.05	3.72

However, although the above tables demonstrated what types of talk the participant engaged, they did not show which types of talk were significantly more frequent. To find this out, the mean total of all talk was calculated at 5.55 (18 categories of talk divided by 100).

Based on this, the overall standard deviation was calculated. In the non-structured task this was 4.43, and in the structured task this was 6.69. The standard deviation was then taken as a baseline (value = 0). The percentage portion of each category of talk was then added together and divided by nine (total number of dyads participating). This gave the average value of each category of talk. From each average the mean was subtracted and the values for each category of talk, as shown in Figure 9:1 and Figure 9:2, were obtained. Those categories of talk that fell at or above the SD value were the categories of talk considered the most significant.

In the non-structured task the most significant categories of talk were musical suggestions (S1), musical extensions (E1a), questions (Q), and positive support/agreement (SUP1). In the structured task this was also musical extensions (E1a), questions (Q) and positive support (SUP1). This finding was interesting as it indicated that although the task instruction was very different, similar types of talk were engaged in in both settings. However, given the way in which the task was set up, it was not possible to compare or contrast the settings.

Taking this into account, it was considered more productive to explore in more detail the similarities between the settings, focusing in particular on how the partners developed their ideas and drew on their previous musical knowledge, the task instruction and their functional understanding of the keyboard. The following section explores these themes through analysis of the social and temporal dynamics of the participants' interactions in both task settings.

Figure 9:1: Keyboard: school, non-structured task setting

Most frequently occurring categories of talk (mean, 5.55; SD = 4.43; n = 9)

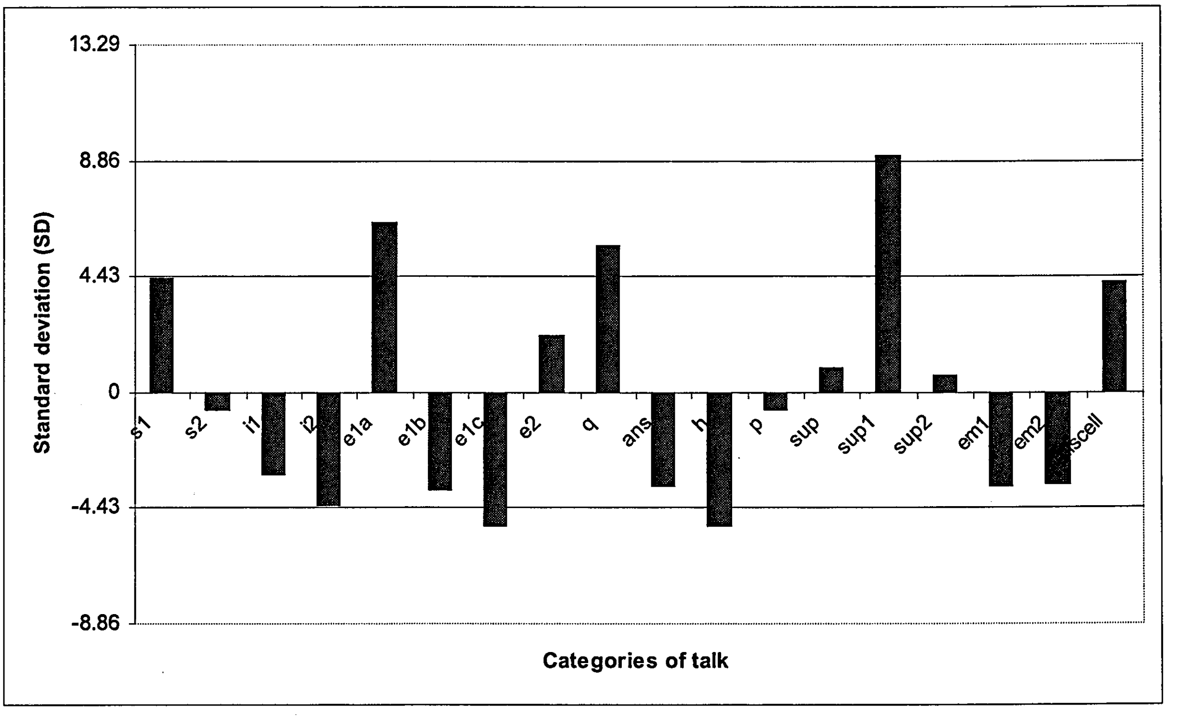
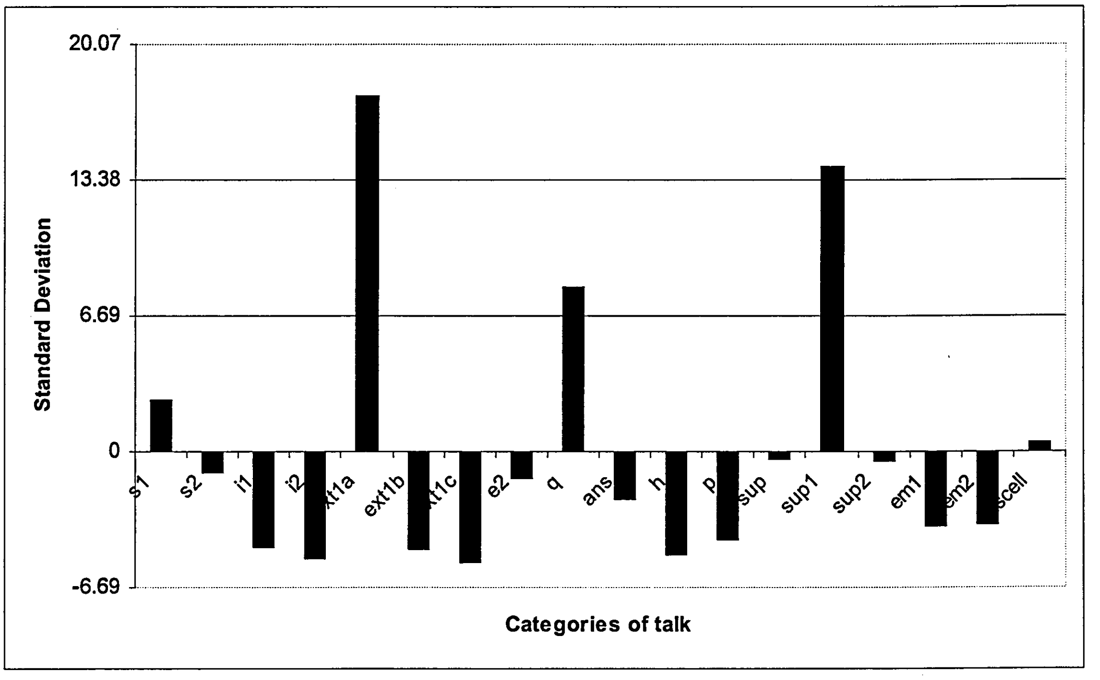


Figure 9:2: Keyboard School, Structured task setting

Most frequently occurring categories of talk, (mean, 5.55; SD = 6.69; n= 9)



9.4.2 Qualitative, interpretative analysis

9.4.2.1 The cyclical nature of the creative process

Sequence 9:1 illustrates the cyclical nature of the creative process as participants initially explore and listen to various samples. Open-ended phases of sample exploration were important as participants found samples they liked and associated with.

On finding a sample such as 'jet plane' (Line 27) and effects like '154' (Line 8) and '187' (Line 17)[10], participants began to develop what was considered as a shared 'musical narrative', through which they built their musical scenarios, in this case the 'Halloween' (Line 25) scenario.

[10] All the keyboard samples and effects had a number and name.

On finding this scenario or theme/motif, they began to use this as a lens or framework through which they made further sample selections. This led, to more in-depth phases of exploration and critical listening as participants began actively to choose sample which fitted the 'Halloween' theme.

Sequence 9:1: Keyboard: non-structured task, Dyad 4: cyclical nature of the creative process

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
3	1	J	Q	What should we do? (Whispered, but can read his lips)
4	1	D	A	Try record (D speaks low)
5	1	J	SUP	mmm (takes D's hand away from keyboard)
6	1	D	X	xxx
7	2	D	SUP	mmm
8	3	D	E2	154 (ref to keyboard dial)
9	1	J	SUP1	Eh (J and D play, D prog using keyboard dial)
10	1	D	S1	... Fusion (s.n.)
11	1	J	SUP1	Now (D prog, J playing, both play)
12	2	J	SUP1	Eh, yeah
13	3	J	S2	Put it too eh, mmm... number
14	4	J	SUP	um...
15	1	D	SUP	uh... (using the keyboard dial to scroll through samples and effects)
16	1	J	SUP	Um
17	2	J	E2	Yeah, 187, I think it was
18	3	J	E1a	Standard and uh goin'

19	1	D	E1a	Yeah I thought, well, yeah we push it down here
20	1	J	SUP	mmm (prog)
21	1	D	i1	Pig (i.e., the sample sounds like a pig)
22	1	J	E1b	Horse (i.e., the sample sounds like a horse)
23	2	J	Q	Shall we record that?
24	1	D	E1b	Doesn't sound like a meow (both listening to sounds and hit keys at random points, one playing after the other)
25	2	D	i2	Halloween (D makes association between the sounds he hears and Halloween, this theme is later used to develop a 'scary' composition)
26	1	J	SUP	hmmm (in agreement)
27	1	D	S1	Jet plane (s.n.)
28	1	J	SUP	Hmmm ... (sits back at sounds)
29	2	D	EM1	Gosh this is wicked...
30	3	D	X	xxx xxx
31	1	J	S1	Hit something (both hit the keys together, J grins at the sound they have found which they think is cool. They listen to it again and straight after break into playing the keyboard together)

Note; s.n. = sample name; prog = programming the keyboard

9.4.2.2 Developing ideas – building on previous musical knowledge

In both task settings, participants incorporated elements of music and tunes that they already knew in order to help them compose together.

For example, Sequence 9.2 from the structured task setting illustrates how participants K and P appropriated simple children's nursery rhythms to make up the ABACADA structure. For example, they used the tune of 'Mary Had A Little Lamb' as the 'last' (line 70) section in their piece, with K writing down the notes on the composition sheet and P working on playing the sequences. When K did not remember all the notes to 'Mary Had A Little Lamb ('what does it go like again?', Line 72), they worked together, co-remembering the notes. Although it was not clear where they had previously learnt this piece, their joint effort and shared memories of the piece were clearly invoked and used to supplement their ritornello structure.

Sequence 9:2 Keyboard, Structured Task, Dyad 1: Previous musical knowledge

Line No.	Turn	Participant	Code	Transcribed discourse and notes
63	2	K	SUP1	Ah ....in it goes
64	1	P	SUP2	No, no
65	1	K	SUP1	Are right, copy that along though
66	1	P	S1	I thought, Mary Had A Little Lamb (K and P play the tune. K then plays it again and begins to play and write down the sequence on the task sheet. P starts to play something else while K does this)
67	2	P	Q	Did you like that one? (referring to the song she was playing)

68	1	K	Q	Many?... [i.e., how many notes in Mary Had a Little Lamb]
69	1	P	SUP1	Many (plays)
70	1	K	S1	That can be the last one (that is, that Mary had a Little Lamb can be the last song or sequence that they fit into their composition pattern)
71	1	P	SUP1	Alright
72	1	K	Q	What does it go like again? (P plays, Mary had a Little Lamb)
73	1	P	A	No, that not it
74	1	K	E1a	I think it went
75	1	P	SUP1	Alright maybe

Sequence 9:3 from the unstructured task illustrates how the participants' shared filmic references also influenced their compositions. Participants F and M had learnt in their current school year[11] how to play the theme tune to the movie *Titanic*. They explicitly referenced the film music score in Line 63, referring to one of the lines in the song, 'My heart will go on'. This reference explicitly demonstrates how the participants drew on their existing school musical repertoires to co-develop and create their compositions together. This small demonstration highlights the potential for formal music lesson activities to influence and transfer to semi-formal music making tasks.

[11] Information provided by the teacher

Sequence 9:3:Keyboard, Non-structured Task, Dyad 7: Film references

Line No.	Turn	Participant	Code	Transcribed discourse
63	2	F	S1	Shall we play 'my heart will go on' from the beginning [refers to the theme tune of the film Titanic]
64	3	F	i2	r'n'b [reference to the sample they are listening to along with playing 'my heart']
65	1	M	SUP1	Exactly
66	1	F	EM1	No leave it on its funny
67	1	M	X	xxx xxx (mumbles something, seems to be referring to having to take it off)

Dyad 8 was one of the most accomplished keyboard dyads. Both players had what was considered, in this context, a high level of practical playing skills (both played with two hands) and they regularly played and improvised music outside of school. In both the structured and unstructured task they worked on a piece that they had been composing, prior to this study. Their composition was influenced by their Indian backgrounds, and their particular speciality was to mix traditional Indian pieces with modern sounds taken from the keyboard's effect program. Although this background was not specifically referred to within their dialogues, after the structured session participant H explained to the researcher that their composition was influenced by the music they played together in their community during different religious festivals.

In sum, the above evidence showed that in both task settings participants appropriated music previously learnt or listened to in other contexts within their composition process.

9.4.2.3 Developing ideas - using the keyboard samples and effects as a source of inspiration

Notation was the term given to the process in which participants called out and wrote down the notes and labelled their sequences as A, B, C or D in relation to the structure they were given. Although it may seem obvious to state, but this notation type of talk was *only found* in the structured task (see Sequence 9:4). This is not surprising as in this task partners were specifically required to engage in recording the outcomes of their compositions (see Appendix 5, task sheet), and it again indicates how participant interactions within this structured task were tied to the predefined task goals. It was interesting to see how participants achieved this through a mix of play-call-write responses, where one participant played and called out the keyboard notes, and the other wrote them on the task sheet, as evident in the transcription shown in Sequence 9.4.

Sequence 9:4: Keyboard, structured task, Dyad 7: notation

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
157	1	M	E1a	We start, D, E, F, E
158	1	F	E1a	F, E yeah (F writing, M playing sequence)
159	1	M	E1a	B (calls out the note for F to write down)
160	1	F	E1a	B (repeats the note, while writing it down)

161	1	M	E1a	D (pause F writes it down)
162	2	M	E1a	D, F, D (pause F writes it down)
163	3	M	E1a	E, F, E, F (pause F writes it down)
164	1	F	Q	Again
165	1	F	XXX	xxx xxx
166	1	F	E1a	E, G, B
167	1	M	Q	OK what have you written? (takes sheet from F)
168	1	F	SUP1	OK
169	1	M	E1a	Let's see, C, D, E, F, G, D, E, F (M calls out the notes)
170	2	M	E1a	C, D, E, F, E, D, E, F, E, G (play it again)
171	1	F	S1	Play it back (i.e., play back what we have written down on the

Overall, in the structured-task setting, participants followed a much more linear sequence of composing, working through the ABACADA structure, creating each section, playing the notes, calling them out and writing or notating them on their compositional task sheet, until they reached the end or got as far as they could in the given time. However, in composing each section they worked in a much more open-ended, cyclical way, similar to that found in the unstructured setting.

As exemplified in

Sequence 9:5, this particular dyad was interested in exploring the keyboard's sounds and effects. Their approach to composition was driven by the use of the samples and effects as a means of creating 'musical scenarios'. This term was used to describe how the partners jointly listened to the keyboard's pre-recorded sample bank and effects and developed analogies or associations, which supported the development of particular musical themes or scenarios. For example, see Line 45 ('its like walking at xxx dark xxx at some point in the cold'). Here, partner H, on hearing the keyboard sounds, begins to create a 'scene' or story that S extends with ideas about 'mad tricks' (Line 46) and H further extends by referring to 'magic' ('And then magic comes and makes it', Line 47). This 'dark, mad, magic' scene sets the atmosphere from which they select other complementary and relevant sounds (e.g. like the 'owl' sound, Line 48, and people 'whistlin', Line 51).

In this respect, the sound samples that the keyboard offered or afforded elicited joint imaginative accounts, generated by the participants' shared listening experiences and interpretations of the sample sounds. These joint imaginative associations were extended to create scenarios on the basis of which new ideas about how to construct the composition were discussed. As illustrated in Sequence 9.5, the participants specifically co-developed a theme or an 'atmosphere' (Line 61) from which they built the structure of their composition, which in turn determined the notes they selected. These discussions led to the development of a shared musical understanding, while simultaneously, in selecting and refining their musical scenario, they began to constrain their ideas. This constraining effect is central to the creative process, otherwise participants would remain in the exploration, brainstorming phase and fail to move on and complete their task. In 'hooking' their ideas on to one central musical scenario, they created a framework within which they worked, which allows them to engage in more refined exploration and discovery phases.

Sequence 9:5: Keyboard: structured task, Dyad 3: keyboard functions and effects

Line No.	Turn	Participant	Code	Transcribed discourse and notes
45	9	H	i1	It's like walking at xxx dark xxx at some point in the cold
46	1	S	E1b	Where, where that one hasn't got mad tricks
47	1	H	E1b	And then magic comes and makes it xxx ... (waves her hands like magic wand)
48	1	S	E1b	That's an owl (playing low notes)
49	2	S	E1b	Owl bitten and don't know
50	1	H	SUP1	Yeah (plays on her side of the keyboard up and down the keys)
51	2	H	E1b	And then loads of people begin whistlin'
52	1	S	SUP1	Oh yeah
53	2	S	SUP1	And wait what's this
54	3	S	E1a	B, B, E
55	1	H	E1a	B
56	1	S	E1a	B, B sharp
57	1	H	E1a	No B, just B
58	1	S	Q	Just like this once, long xxx
59	1	H	i1	xxx xxx, there are loads of people blowing xxx ... atmosphere

60	1	S	Q	That one (referring to key)
61	1	H	E1b	Atmosphere
62	1	S	E1b	Yeah people, people
63	1	H	E1b	And then magic

In comparison with the previous example, Sequence 9:6 (Lines 232-235) from the unstructured task setting demonstrates how participants' different associations and perceptions of the sample 'thunder' could also be a source of tension, which needed to be negotiated before participants could move on.

As highlighted in Sequence 9:6, K suggests using some of the 'thunder' sample. However P thinks this would ruin the sequence, particularly as the sample 'scares' her a bit (Line 234). Interestingly, P also gives the reason that the composition is 'supposed to be all...' (Line 234, waving her hands and nodding her head), which was her way of saying that the composition was supposed to have a certain mood or atmosphere, that it was supposed to be 'scary'. Despite P's inability to clearly verbalise and articulate what she means, K acknowledges her point of view as they have both already established a shared musical understanding of what they want to achieve. This was previously established when they went through the samples, listening to them critically and deciding on what they liked and disliked. During this previous phase, they had decided on using samples such as 'wind' and 'chimes' to create an 'atmospheric' soundscape. Consequently, it is within this shared musical schema that the merits of the current thunder sample were negotiated.

Sequence 9:6 Keyboard, Non-Structured Task, Dyad 1: Keyboard functions and effects

Line No.	Turn	Participant	Code	Transcribed discourse and notes
231	1	K	S1	Shall I put some thunder in
232	1	P	E1a	No coz you'll ruin it with the thunder
233	1	K	E1a	No just a little bit
234	1	P	E1a	No that scares me, it's supposed to be all... (waves hands and nods her head expressively)
235	1	K	SUP1	Yeah

9.4.2.4 Working through problems

Within the unstructured task, Sequence 9:7 highlights how participants used specific effects ('ethnic flip') to supplement the filmic score they appropriated within their composition. As previously noted (see Sequence 9:3), this dyad used the theme tune of the film *Titanic* within the composition. The r'n'b reference in Sequence 9:3 refers to participant F's description of the sample they were listening to and one that she wanted to use to supplement the composition. However, M wanted to try the sample 'ethnic flip' which F thought was 'boring'. As M looked for the 'ethic flip' sample, F continued to think M's efforts were 'boring' or 'sad' and actually called her a 'stupid thing'. As M scrolls through samples, she hits upon another sample, which integrates them both. This particular extract ends with the participants listening to the new sound in combination with the *Titanic* theme tune and F commenting that it sounds 'sexy' (Line 86), while participant M seems undecided and preoccupied with searching for another sound.

Sequence 9:7: Keyboard, Unstructured Task, Dyad 7: Negotiating understanding

Line No.	Turn	Participant	Code	Transcribed discourse and notes
68	1	F	EM2	Oh be boring then
69	2	F	S1	Put ethnic flip (s.n.) on
70	1	M	Q	Where?
71	1	F	E2	159 (referring to the keyboard programme number where sample ethnic flip is)
72	2	F	E2	Where's 159?
73	3	F	EM2	Boring…
74	4	F	E2	OK and song 69,
75	5	F	EM2	God, its rubbish
76	1	M	X	xxx xxx (mumble)
77	1	F	EM2	It's a bit sad, see what I mean (M laughs)
78	2	F	E2	Song 69, no 69
79	3	F	EM2	Wait, you stupid thing
80	1	M	E1a	Style 69, oh I think its 59 actually
81	2	F	SUP1	Hold on a minute
82	3	F	SUP2	No it isn't
83	4	F	S1	Start
84	1	M	E1a	1, 2, 3 (counting themselves in and they play)
85	1	F	E1a	Sounds a bit em (commenting as they play)
86	2	F	EM1	Sounds so sexy
87	3	F	Q	What was that all about?
88	4	F	E2	I'm sure it was 59 now

89	1	M	Q	(Hands spread out, appears to be indicating that the time is incorrect, does this action twice)...finish it
90	2	M	X	xxx xxx
91	3	M	i1	Sounds a bit em...
92	1	F	E1a	The song's
93	1	M	E1b	Heavy
94	1	F	E1b	Bit em...in the mood music
95	1	M	Q	Are you sure it was 59?

(s.n. = sample name)

In sum, the above example of the collaboration between M and F also demonstrates how partners were observed working through periods of dissonance. As exemplified in the above sequence, partners avoided direct and drawn out argumentation in favour of working though the problem by either listening to other samples or finding an alternative one they both liked and/or ignoring the problem. In terms of collaborative learning, the latter is often considered, as the least productive strategy as there is no attempt to resolve the situation. At the same time, it is also necessary to consider why people choose to ignore group tension. In some circumstances this may be the most productive strategy to follow in order for the goals to be reached. The next sequence (9:8) also highlights how individuals' perceptions of each other's and differences in ability can also hinder the process.

The interactions observed in Dyad 2's structured and unstructured task settings were problematic and this was believed to stem in part from the difference in age and in musical ability between the participants. Participant A was older than, and in a different school year (Year 10) from his partner R1 (school Year 9). It seems that this age difference, along with his ability to play the keyboard better than his partner (i.e.

with two hands, using all fingers), led A to dominate the interactions. Additionally, A did not take on board R's suggestions, consequently R1 became submissive, simply taking A's instructions, and so little joint construction or co-creativity was found or observed during their sessions. Also, R1 referred to himself as a 'rubbish' player during their interactions (see Sequence 9:8) and his self-esteem in the sessions was not helped by A's domineering attitude. It also appeared, within their structured session, that R1 had made some sort of deal with A before the session started. This was never explicitly mentioned, aside from the last utterance highlighted in this sequence: 'Remember what I said ... I am rubbish.' This, along with another utterance from a previous sequence where he noted 'Remember what I told you', led to the conclusion that R1 had made some sort of arrangement with A before the session began about who was to do what during the session.

Sequence 9:8: Keyboard, structured task, dyad 2: non-productive relationships

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
45	1	R1	EM2	What ... I'm rubbish
46	1	A	S1	Play it
47	2	R1	E1a	You do it, I can't play it
48	2	R1	EM2	I'm rubbish
49	2	R1	Q	Like what? (Referring to what he could play)
50	1	A	E1a	Just phono it, just play something there, just phono (unclear what he means by phono, however it is believed to be relating to the programming)
51	2	R1	EM2	Play it, I'm rubbish, I'm rubbish, like what (repeating his previous

				response)
52	1	A	S1	Just play
53	2	R1	A	You play
54	1	A	S1	Just play
55	2	R1	A	You play
56	2	R1	E1a	Remember what I said ... I'm rubbish (A plays and R holds keys then takes one finger away and plays the note again)

What is interesting about R1 is that he was also part of another dyad, Dyad 5 (as noted previously, the selection of participants was outside of the researcher's control). When he worked within a partnership, with someone of his own age and from the same year group, R1 played a much more active role and even brought some of the information that he had learnt with partner A into the session. This was not demonstrated in the verbal dialogues but was picked up in the music he played, as when he had been working with A, they had been playing a popular chart piece. At the end of the session, with A, R1 had asked A to teach him it, which he appeared to have done, as in R1's session with R2 he was observed to play it with R2. This interaction highlights how, even when the partnership may be flawed, it can lead to learning opportunities. The implications of such working relationships are returned to in the discussion section.

9.4.2.5 Division of labour

Observed within the dialogues in both task settings was talk around the division of tasks and labour. The design and interface of the keyboard, differences in skill and ability, and in the nature of the task itself predominantly influenced these interpretations.

9.4.2.5a The role of the keyboard in the division of labour

Keyboards were originally designed for individuals to play; when two people work around them, partners have to sit side-by-side at either end of the keyboard. Consequently, due to both partners physically sharing the space, not all of the keyboard's functions are within easy access to both players. This physical organisation around the keyboard consequently influenced the division of labour. For example, if a partner was considered as more competent in recording and saving the work, then they sat at the end of the keyboard nearest to these functions. This division of task also appeared to acknowledge that participants knew each other's strengths and weaknesses, and there was evidence in the talk of this shared, experiential knowledge. Consequently, in some cases the participant who was considered or perceived as 'more musical' played for greater periods of time, while the other 'less musical' participant worked on other aspects of the composition, such as adding effects, saving and recording the composition or, in the structured task, writing the notes of the composition down on the task sheet.

As noted, as well as being adaptable to each other's existing knowledge and expertise, the keyboard's interface also created opportunities for a participant to appropriate certain roles, such as the 'programmer' or the 'player'. Therefore, as a shared musical tool the keyboard allowed two players to work and play together and jointly compose and arrange music.

It was also interesting to observe how different dyads used the keyboard. Although the examination of individual differences is not the focus of this thesis, it cannot be ignored entirely. Dyads' abilities, skills and confidence in using the keyboard varied. For example, Sequence 9:9 (unstructured task setting) illustrates how, in the case of Dyad 8, partners' knowledge of each other's skills influenced which player played which part, and their subsequent position around the keyboard. As noted, this dyad was one of the most musically experienced and played together both in and outside of school. In the example, Y explicitly asks whether H wants to 'split' or divide the roles (see Line 6), with Y playing the drum parts (Lines 7 and 8) and H the instrumental part. In addition, H always programmed and saved the compositions (see Line 9), while Y directed the piece (as demonstrated in Line 6) and ensured that they completed the task. Further evidence of these roles was deduced from the video analysis, as it was H who, on entering the room, immediately sat beside the main programming and saving functions, and when the dyad experienced some programming problems it was H who solved them.

Sequence 9:9: Keyboard, non-structured task, dyad 8: Keyboard and division of labour

Line No.	Turn	Participant	Code	Transcribed discourse and notes
5	2	H	S1	This (playing)
6	1	Y	Q	Do ya wanna split? [that is, split the parts]
7	1	H	A	You can do drums
8	1	Y	E1a	I want to do drums anyway I think, do
9	1	H	SUP1	Here (Y starts playing, H programs)
10	1	Y	E1a	Let me see what I got

9.4.2.5b *The role of the task instruction in the division of labour*

Within the structured task, the division of labour was also guided by the instructions given, to compose a tune using the ABACADA structure and to record the composition structure on a sheet. To achieve this, participants divided the task, with one participant playing the piece and calling out the notes, while the other wrote down the notes on the sheet (see Sequence 9:10 from the structured task setting, Lines 99, 112-113). As in the previous example, the partners in this sequence also talked about 'splitting'; this referred to playing different sections of music that they already knew in order to build the ABACADA structure. Dividing each section between them ensured, for them, that their timing was tighter (see Lines 100-102, where this problem is identified and the solution to play a section each reached). As evident in their non-verbal communication, partner's smiles and their supportive nods when the task was finished demonstrated that they enjoyed this approach to playing and composition.

Sequence 9:10: Keyboard, structured task, dyad 6: task instruction and the division of labour

Line No.	Turn	Participant	Code	Transcribed discourse and notes
99	1	K	E1a	That's one G, so write it in then, G, A, G, B, G, B, G, C, G, D
100	1	V	E1a	Yeah, but time...time isn't it, that ain't right xxx
101	1	K	E1a	One person does G, B one person does G, C
102	1	V	E1a	Oh yeah alright, split it in half ain't it, hold

				on
103	1	K	SUP1	Yeah (nods head)
104	1	V	SUP1	OK, so I'll do mine, yeah
105	1	K	SUP1	Yeah (nods head)
106	1	V	E1a	When you've done it, I'll have done the tune, my tune
107	1	K	E1a	I start after remember
108	1	V	SUP1	Yeah (nods head)
109	2	V	Q	So, what you do?
110	1	K	E1a	I did G, A
111	1	V	SUP1	OK, hold on ...
112	2	V	E1a	F, G, oh hold on F, G, xxx yeah (writes notes on composition sheet)
113	1	K	E1a	(Leans over to help V figure out notes she just played) ... 2, G2, 2, G, G2, after G2, C3
114	2	K	E1a	C3
115	3	K	Q	Where did you stop off?
116	1	V	S1	Ok, now we can, we say, you can come in (look at each other, smile)
117	1	K	SUP1	My turn

9.5 Discussion, conclusions and recommendations

The main aim of this chapter was to investigate:

What kinds of dialogue were the young people engaged in when working together using keyboards on a typical structured and unstructured task in a school setting?

To address this question, the coding scheme developed for this thesis was applied and the results analysed on a quantitative and qualitative level.

9.5.1 Summary of the quantitative analysis results

The quantitative analysis indicated that, in the unstructured task instruction setting, musical suggestions (S1), musical extensions (E1a), agreements (SUP1), and questions (Q) were the most frequent types of talk in that setting; while in the structured task, musical extensions (E1a), agreements (SUP1), and questions (Q) were the most frequently occurring types of talk. The high frequency of positive supportative talk (SUP1) and questioning (Q) indicated that the young people were attuned to each other's needs and mutually engaging with each other. Evidence of such dialogue was considered important for continued joint action (Brown, Collins, & Duguid, 1989; Feldman, 1990; Kumpulainen, 1996; Wells, 1987). In addition, given that musical extensions were one of the most frequent types of talk in both settings, one can conclude that participants were engaging with each other's ideas, extending them and establishing joint musical meanings.

Much of the research carried out on collaborative task instruction (Bennett & Dunne, 1991; Cohen, 1994; Kumpulainen, 1996; Kumpulainen & Mutanen, 2000; Van Boxtel, 2000) has found that the quality of participant talk is closely linked to the nature of the task design and structure. This study supports this body of work. Although it was not the aim to compare both task settings, it was expected that there would be greater differences in the quantity and quality of the talk engaged in between the tasks. However, in light of the analysis and the way in which the study was ordered and carried out, it is not surprising that the settings were more similar that different.

A main factor in this was that the structured task instructions to compose a piece following an ABACADA structure had largely open-ended, unstructured components within it. Therefore, it is best considered as a semi-structured task. Extending Morgan's (1999; Morgan, Hargreaves & Joiner, 2000) call for more in-depth knowledge on how the different task instructions influence music technology collaborations, it would seem that, in relation to keyboards, teachers should be more aware of how their task instructions can lead to similar and even repetitive levels of musical engagement.

9.5.2 Summary of the qualitative analysis results

9.5.2.1 The appropriation of previous musical knowledge

In both task settings, participants applied and appropriated their own individual and shared musical knowledge. For example, the use of traditional and religious Indian tunes, rhymes such as 'Mary Had A Little Lamb', and the theme song from films such as *Titanic*, demonstrated how their prior musical experiences allowed participants to develop their compositional ideas jointly. This finding also highlighted how musical experiences were drawn on from situations outside the classroom and how partners utilised their musical knowledge, making it their own and using it to transform and achieve their goals.

This form of musical appropriation was considered an interesting area and it is investigated further in the following empirical chapters.

9.5.3 The keyboard as a partner in the creative process

The keyboard facilitated the young people's music and collaborative practices by creating a space for partners to work and test out ideas, explore possibilities and experiment by playing different notes and samples. Importantly, the pre-recorded sample and effects bank embedded within the software was a source of inspiration in both task settings, while the save and record features allowed the participants to listen to and edit their work immediately.

In this respect, the study added to existing work (see Appell, 1993; Chamberlin et al., 1993) on keyboards by specifically looking at what kinds of creative and collaborative processes it supported. The study specifically addressed Salaman's (1997) call for establishing where the appeal of keyboards lies and what their advantages are for music education. The study demonstrated that keyboards can mediate and structure creative collaborations by providing a joint working space in which young people can explore and test their ideas and bring their musical knowledge and skills together in a process of joint music making. However, the findings also demonstrated how the keyboard could also be a site of tension, particularly if one partner was more domineering and took control of the keyboard functions and play space. In this respect, tasks around school keyboards need to be monitored so that unproductive or bullying partnerships do not have the opportunity to thrive.

Apart from this, the main problems experienced by participants were due to their lack of technical knowledge about how to operate the keyboard and lack of practical playing skills (from one-finger/two-finger to one- and two-handed playing). In this respect, it would be beneficial in keyboard lessons for teachers to ensure that pupils had a good grounding in the keyboard functions and some basic playing-skill lessons.

As noted, the participants in this study used headphones and consequently this influenced how well they communicated with each other verbally. Although when making music verbal communication may not always be needed, when composing together, to maximise the potential for successful collaboration, it was considered that the pupils should be encouraged to use as many channels of communication as possible. Future research in this area would benefit from examining what are the real benefits of keyboard labs, especially where pupils are working using headphones and their ability to communicate together is restricted.

Finally, although this study was carried out in a school setting, the session took place during lunchtime and it would be advantageous to explore how music technologies are used in naturalistic school settings. The following study focuses on this specifically and on the processes engaged in when working with music technologies during regular music lessons.

9.5.4 The creative, compositional process

In the structured task setting, participants were observed following both linear and cyclical compositions processes. Linear composition referred to how participants worked sequentially through the ABACADA compositional structure that the teacher had given them. Partners who worked in this way tended to appropriate existing pieces of music, fitting them into the above compositional pattern, while other partnerships were observed either combining existing music pieces with their own new creations or, in some cases, making up complete new sections. In the unstructured task, although there was no predefined structure, participants engaged in a similar way by appropriating pre-existing pieces of music, or mixing them with their own compositions, or creating entirely new pieces. As noted, this highlighted how complex the compositional process was, as the differences between the two task settings were therefore ambiguous.

From the sequences of dialogue where partners were creating entirely new pieces, there was evidence to suggest they were engaging in similar spiral-like, cynical processes of sample and effects exploration and selection, arranging, critical listening, editing, refining, recording and saving. The keyboard supported this process by providing participants with an immediate source of sounds from which they could select and sculpt their pieces. One of the keyboard's main advantages was that it allowed participants to save and listen critically to their work, which in turn drove further periods of exploration, listening, editing and refining.

It would be interesting to carry out further work on the nature of the creative process, and the following chapters explore this issue in greater detail, particularly when partners are engaged in working with computer-based music technologies. The following study focuses on this in a more naturalistic school setting.

9.5.5 Task division

As evident in the dialogues, partners' knowledge of each other's skills influenced how they shared and divided the task. The instances discussed highlighted how partners can learn from each other by working on keyboards, demonstrating the potential of the keyboard as a tool for peer learning. In particular, the appropriation of certain roles, such as the 'programmer' and 'player' (in both task settings) or 'player' and 'scribe' (in the structured task), demonstrated how both the keyboard interface and the task instruction influenced partners' coordinated actions.

9.5.6 Working through problems

As noted, the keyboard itself could be a site of tension, particularly if one partner dominated the controls. In addition, if partners were in verbal disagreement with each other regarding a sample or section of composition, it was found that they tended not to work them out verbally. Instead, they generally chose to resolve issues musically, by searching for some sample to illustrate their point of view or by listening to alternative solutions until both partners were satisfied. However, as noted, some problems were ignored, which did lead to non-collaborative working relationships.

9.6 Final conclusions and new steps

In conclusion, this study adds to the knowledge (Folkestad, 1998; Folkestad, Hargreaves, & Lindström, 1998) about how young people compose using music technologies and specifically how they create music when working together on the keyboard. It also addressed key issues highlighted by Salaman (1997) about the implications, issues and value of using keyboards in school music teaching. The study also went some way towards demonstrating the implications of the task instruction on musical interactions and production, particularly when working on the same instrument. Importantly, this added to the body of knowledge of how technologies are used for composition, which, as highlighted by

Salaman (1997) and the survey carried out as part of this thesis, was severally lacking.

In sum, based on these findings, it would be interesting to further examine how young people create music together using different music technologies, such as the computer, particularly in more formal school settings. The following chapter builds on this topic.

10. An exploration into young people's creative, collaborative compositions using eJay during formal school music lessons

10.1 Introduction

In comparison with the previous study, which focused on the use of keyboards, the second study presented in this thesis examined young people's interactions during a normal school music lesson, using music software called eJay (http://www.ejay-uk.com/). eJay is a CD-ROM-based program, containing pre-recorded vocal and instrumental samples that allow users to compose, arrange, edit and record music in dance, rave and hip hop styles. The rationale for examining this computer-based music software stems from the findings of the survey study presented in Chapter 7. Results from that study indicated that eJay was popular in UK secondary schools and that young people most commonly worked in groups during computer music sessions. Despite this, there is a lack of knowledge about how young people compose music together around computers during normal school music lessons.

This chapter specifically addresses this by focusing on young people's composition processes using eJay software. The chapter builds on the previous study by further examining the nature of the creative process when working on music technologies, and overall the chapter aims to add to the emerging understandings of how the contextual relations within a particular setting influence the creative process.

10.1.1 Computers for learning and music making

In Chapter 0 of this thesis the mediating role of the computer in learning was discussed in detail. To recap briefly, research has indicated that the computer is a valuable tool for facilitating learning and supporting social interaction (e.g. Crook, 1994).

During recent years, many researchers within music education have addressed the potential that computers and music technologies have in developing learners' creative potential (Folkestad, 1998; Hickey, 1997; Seddon & O'Neill, 2001a; Webster, 1994) and in teaching musical concepts and ideas (Ellis, 1997; Resse, 1994; Webster, 1995; Wiggins, 1989). In general, this work views the incorporation of ICT tools in music education positively, in that they can potentially assist learners to create and engage more with music. However, the majority of this work focuses on *individual* learning rather than *collaborative* settings. Consequently, research on ICT within music education fails to address adequately how computers mediate the collaborative music process in classroom settings, and what kinds of creative process they support is largely unknown. In sum, to reiterate, the aim of this study was to explore how computer-based software eJay was used during a typical school music lesson.

10.2 Research questions

This research questions addressed in this study were:

1. What kinds of dialogue did the young people engaged in when working together using eJay during a typical school music lesson?
2. How did eJay influence the creative, collaborative process?

10.3 Method

10.3.1 Setting

The study was carried out in two UK co-educational comprehensive schools. In both schools, the music teachers had just begun to use eJay during lesson time. The physical layout and organisation of the class were similar in both schools; the rooms contained sequenced keyboards with five or six computers, arranged around the walls of the room. In both schools, the class divided into those working on keyboards and those working on the computers using eJay.

In School 1, groups (dyads and triads) worked on both keyboards and eJay, while in School 2, dyads only worked on eJay, while individuals worked on the keyboards. In both settings, the participants observed working on eJay did not wear headphones (see Image 10.1).

Image 10.1: Participants using eJay

10.3.2 eJay software

Put simply, eJay allows users to turn their PC into a mini recording studio (see Image 10.2). The software is designed around a series of visual and colour-coded arrange and sample pages. All the samples are pre-recorded, with different colours representing a different type of sample (loops, sequences, drums and so forth).

Image 10.2: eJay Interface

Music is created by dragging and dropping the pre-recorded samples on to an 'arrange' or visual editing page, which allows participants to assemble their compositions. Other functions such as changing volume, repeat, rewind and fast forward are symbolised by buttons, which are similar to those commonly found on recording and video equipment.

Since its emergence in 1994, eJay has become one of the leading music programs. Commonly used in educational settings, the first of the series, Dance eJay, was released in 1997 and since then other forms such as Hip hop and Rave have emerged. Since beginning this research, a thriving online community has emerged around eJay (www.eJay.com), which offers a platform for musicians to showcase the tracks they have made and exchange tips and ideas about making music with others.

At the time of conducting this research (2000-2003), eJay was available in three popular music styles, Dance, Rave and Hip hop music. The main distinction between the styles was that the Hip hop version enabled users to create scratch effects; this is not possible within the Dance and Rave versions. The method to create scratches involved dragging the computer mouse over a 'virtual vinyl' version of the compositional track, which was not very different in function from the click and drag principle used in the other eJay types.

10.3.3 Task

The study was carried out during normal class time with each recorded session lasting as long as the class time. The average *composition time* in School 1 was 42.09 minutes, and in School 2 it was 36.41 minutes. In both settings, the teacher explained the task to the pupils and the session lasted as long as the lesson (including arriving into class; getting into position; sitting down, etc.).

The tasks presented in this study were semi-structured because the teacher set certain constraints on what the pupils had to do, yet the details of the task were left up to the participants. Although the task instruction in each school was different, it was decided to treat the population as one sample. The rationale for this was in keeping with the aim of the study, to explore the use of eJay in school settings and how it influenced young people's collaborative and creative processes. To avoid setting a false task, the preference was to explore what the teacher and young people would do during a normal school lesson.

10.3.3.1 Task instruction: school 1

In School 1, the teacher had just begun to use Dance eJay in the class, and some of the groups participating in the study had already been working on eJay compositions (Groups 2 and 5). Those working on eJay were asked by the teacher to spend the lesson putting into practice what they had learnt so far about riffs, hooks and repetitive motifs using Dance eJay. From School 1, 5 groups were observed (4 triads and 1 dyad). All groups used Dance eJay.

10.3.3.2 Task instruction: school 2

In School 2, the teacher had not used eJay before and none of the groups from this school had been working on their compositions prior to this study. Participants were asked to compose a tune up to of 20 bars, with an introduction, and had to use all sample types (loop, drum, bass, and so forth) available to them. They were advised to keep one motif going throughout the composition and to structure the composition so that there was a 'solid concept' (this was the teacher's term for referring to a strong motif) holding it together. In School 2, two dyads were observed. Dance, Rave and Hip hop versions of eJay were all installed on their computers and pupils were given the choice of which version they would like to use. Both dyads choose to use Hip hop eJay.

Although the participants in School 1 were already introduced to eJay with some groups having started working on their compositions, to separate these groups from the study was considered counterproductive, as the aim was to investigate their creative and collaborative processes, not their final products. In School 2, although the participants had just begun to use eJay, none of the participants had started their compositions. Again, it was considered that, as this study was an exploratory investigation into the creative processes, their inclusion in the study was justified.

10.3.4 Participants and Procedure

Parental permission was obtained for participation in the study (see Appendix 8). When pupils entered the classroom for their music lesson, the teacher introduced the researcher and explained again to the pupils the aims of the research. The teacher explained that participation in the study was voluntary and that they were able to change their mind about being involved in the study and withdraw at any point should they want to. At this point, any pupils who did not want to take part in the study were given the opportunity to withdraw. None of the pupils withdrew from the study. The selection of participants was dependent on who sat at the computer where the researcher's camera was set up (as described in Section 8.5.2). Consequently, neither the teacher nor the researcher had control over the actual selection of participants, as it was up to the participant whether they wanted to sit by the camera or not.

In total, between Schools 1 and 2, there were 3 dyads and 4 triads (18 participants, mean age 13.6 years) involved in the study. In School 1, there were 4 triads and 1 dyad (a total of 11 males and 3 females; mean age 13.7 years). In School 2, there were 2 dyads (1 male and 3 females; mean age 13.5 years). In both settings, participants knew each other, being either friends or acquaintances. All participants were at the same National Curriculum Key Stage (3) and in the same school year group (Year 9). In both schools, participants were accustomed to working in small groups on music activities (see Table 10:1 for a breakdown of the task and participants).

Table 10:1: eJay: *school: overview of the task and participant*

Context	**Group**	**eJay type**	**Mean Age**	**Task Time (mins)**
School 1	1. Male triad	Dance	13.3	42
	2. Male dyad	Dance	13.6	40
	3. Female triad	Dance	14	42.12
	4. Male triad	Dance	14	44.34
	5. Male triad	Dance	13.6	40
School 2	6. Mixed m/f dyad*	Hip hop	14	32.03
	7. Female dyad	Hip hop	13	40.39

m = male; f = female

10.3.5 Analysis of verbal dialogues

The coding scheme, developed for the thesis, was also applied to the data from both school settings. For a detailed account of the development and rationale of the scheme and the software used, the reader should see Section 8.4 and Appendix 7 for a breakdown of the coding scheme.

10.4 Results

10.4.1 Quantitative analysis – descriptive statistics

The same approach was taken to the data as in the previous chapter. Table 10:2 represents the percentage proportion of each category of talk spoken within across all the groups (n=7 groups). From this it can be seen that musical suggestions (S1), musical extensions (E1a), technical extensions (E2), questions (Q), and positive support/ agreements (SUP1) were frequently occurring categories of talk. To find whether these categories of talk were significant, further analysis was carried out. The average of each category of talk was calculated. The mean (5.55) was then taken away from this average to find which types of talk fell at or above the standard deviation of 6.21. From this, the most significant types of talk found in this setting were musical suggestions (SUP1), musical extensions (E1a), and positive support/ agreements (SUP1) (see Figure 10:1). The occurrence of these types of talk demonstrates that participants were co-constructing and sharing ideas, building on their ideas and supporting each other in this.

Table 10:2: eJay *school: categories of talk*

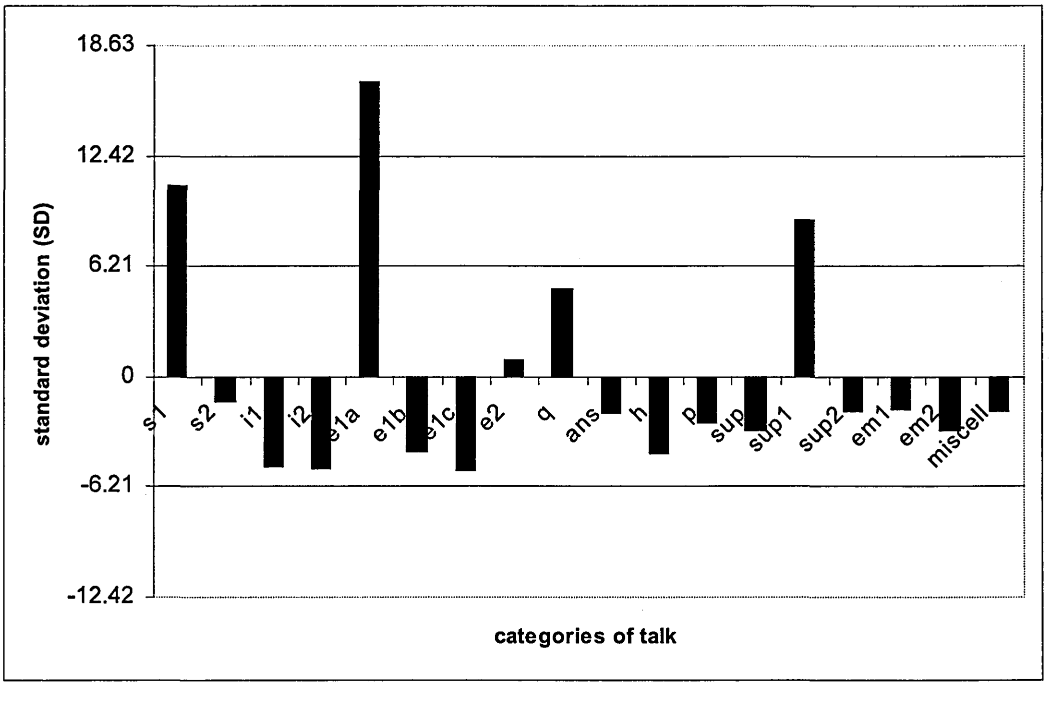
Descriptive Statistics based on proportions of categories of talk (n=7 groups)

Codes	Min	Max	Mean	Std. Deviation
S1	10.66	19.92	16.37	3.72
S2	2.95	5.86	4.13	1.21
i1	.00	.87	.413	.26
i2	.00	1.24	.40	.4
E1a	17.01	26.73	22.12	3.65

E1b	.35	3.02	1.37	.87
E1c	.00	.53	.207	.23
E2	2.28	14.01	6.53	4.11
Q	5.08	17.51	10.48	3.9
ANS	1.56	5.58	3.44	1.6
H	.16	2.13	1.22	.81
P	.00	9.39	2.99	3.12
SUP	.39	4.46	2.50	1.57
SUP1	10.94	16.75	14.37	2.01
SUP2	1.06	5.57	3.64	1.77
EM1	1.62	7.81	3.66	2.01
EM2	.00	8.33	2.52	2.92
MISCELL	1.16	5.32	3.62	1.48

Figure 10:1: eJay *school*

Most frequently occurring types of talk (mean, 5.55; SD = 6.21; N=7 groups)



10.4.2 Qualitative, interpretative analysis

To gain a deeper understanding of how the young people developed a shared understanding of the composition task and co-created their pieces together, a more qualitative analytical approach was necessary in order to examine the more social, temporal nature of the dialogues.

10.4.2.1 The cyclical nature of the creative collaborative process and how eJay supports it

One of the most common ways to generate ideas within both school settings was to use the pre-programmed eJay sample as a source of exploration and idea generation.

Sequence 10:1 illustrates this process, where various samples were clicked on, listened to and evaluated. This extract represented the beginning of an exploration period where participants worked out which samples they would like to use and how they would arrange them. For example, sample names such as 'my life', 'Mikey' and 'whirlpool' indicated how the bank of sample names and types available in eJay was used within the compositional process as a means of generating ideas. The decision about which samples should or should not be included was complex and based on various criteria, such as:

1. *Sound* - if the samples sounded good. For example, 'You can't keep Mikey, its so pants' (Line 92, 'pants' referring to the Mikey sample sounding bad).
2. *Sequence fit* - if the sample fitted into the particular compositional sequence the participants were working on. For example, Line 91, 'a shorter one', refers to taking a shorter Mikey sample so that it fits into the sequence structure they already have.

3. *Whole arrangement* - how the sample sounded when played in relation to the whole arrangement.

This three-step selection process was cyclical: samples were chosen, listened to and evaluated (see lines 85, 90,103, 109 and 111). A combination of decision making and the continued refining of each sample, combined with new stages of exploration, drove the compositional process. Once such decisions had been arrived at, participants then listened to what they had constructed (see Lines 103-105).

During this period of listening participants considered and critically reflected on what they had created, which led to further discussions of the need for more samples at the 'beginning' of the composition (Lines 106-108). However, on listening to how additional samples sounded, they are still not pleased with the overall arrangement. J2 then decides that they should 'take it out and stick it there' (Line 110, referring to the decision to test the new beginning-section samples). They then listen to this new arrangement; the sequence finishes with J1 uttering the word 'yeah' in positive response to it. The rest of the group collectively respond in a non-verbal way, by nodding their heads.

This sequence beautifully illustrates the cyclical nature of the creative process as participants went in and out of periods of open-ended exploration, problem finding, decision making via refined selection and critical listening, macro, whole-compositional arrangement and micro sequencing, editing and refining. In doing so, the moment-to-moment interactions, influenced and constrained by the ongoing dynamics of problem finding and solution, were driven by the collective convergence and divergence of ideas and they co-created their composition.

Sequence 10:1: eJay *school 1, group 3, triad: cyclical creative process*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
80	1	T	S1	My life (s.n.), try my life
81	1	J2	Q	That one, where?
82	1	T	SUP1	Yeah
83	1	J2	E1a	Put it a bit further across, like, good... xxx (placing the samples up, J2 directing J1 where to put it)
84	1	J1	SUP1	There... yeah
85	1	J2	E1a	I knew you'd do that (refers to the s.t.)
86	1	T	S1	Try Mikey (s.n.)
87	2	T	Q	What's that?
88	1	J1	Q	A far one, yeah? (asking whether they should take a 'far' named sample)
89	1	T	S1	Hello (s.n.)
90	1	J2	Q	Where? About there? (J2 puts the sample up beside other vocal samples, then they all listen to it and burst out laughing at the Mickey vocal)
91	1	T	E1a	eh, a shorter one (referring to get the shorter Mikey vocal sample, pointing, J2 takes the above longer Mikey vocal off)
92	1	J1	E1a	You can't keep Mikey, it's so pants
93	1	J2	Q	Where? there? (getting the shorter Mikey sample)

94	1	T	SUP1	Yeah (they listen to shorter Mikey, laugh, take it off)
95	2	T	E1a	We're not having that
96	1	J1	SUP	Here, here, we are (miming the Mikey sample in a high squeaky voice)
97	1	T	S1	More, down (scrolling down more through the vocal samples to get another sample)
98	1	J1	S1	Boom xxx (s.n.)
99	2	J1	S1	Go to sequence (J2 goes)
100	3	J1	S1	Whirlpool xxx (s.n.)
101	4	J1	S1	Water dance (s.n.)
102	1	T	SUP1	Yeah, water dance (pointing)
103	1	J2	Q	Here, here, where about? (J1 points to where it could go, they listen to sample)
104	2	J2	SUP	mmmm (t.t. refers to where they have placed the sample)
105	1	T	SUP	mmmm (t.t.)
106	1	J2	E1a	At the beginning (that is, they place it at the beginning, to where J1 pointed)
107	1	T	SUP2	No, not at the beginning
108	1	J1	SUP2	No
109	1	J2	Q	Where about, there? (listen to the sample)
110	2	J2	E1a	I reckon we should take it out and stick it there (moving samples closer together)

111	1	J1		SUP1	Yeah (J2 then plays comp from the beginning, they all listen to what they have done)

t.t. = talking together; s.n = sample name; s.t = sample type

This second example (see Sequence 10:2) demonstrates how another group entered earlier into more refined exploration stages. Musical suggestions, as exemplified by utterances such as 'We need to put some stuff in there' (Line 91) were more directional than just calling out sample names. This indicated that participants already had an idea that 'some stuff' was needed. Such suggestions exemplified more refined editing and reflection phases of the composition process than the previous example where there were more extended sequences of open-ended exploration, as exemplified by phases of calling out sample names as participants searched for appropriate samples. In Sequence 10:2, the triad had already been working on their composition, as they were at a later stage in the compositional process than the previous group. Consequently, they were more immediate in their musical diagnosis that 'something sounds crap' (Line 92). Participant A proposes that something is needed 'to carry it on' (Line 93); that is, to carry on the motif they are working with in order to solve the issue. This suggestion feeds into a further period of more open exploration, once again identifiable by the calling out of a sample name and by their evaluation.

Sequence 10:2: eJay *school 1, group 5, triad: cyclical creative process*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
91	1	A	S1	We need to put some stuff in there (pointing to last part of comp)
92	1	M	E1a	I know, something sounds crap, I think it's that bit in there
93	1	A	E1a	Yeah, but you need something to carry it on
94	1	M	SUP1	I know, yeah
95	1	P	S1	Like vocal, go to voice (s.t.)
96	1	A	S1	Or that water, or that water, yeah, what's this (s.n.)
97	1	P	S1	Or rap (s.t.)

Note: s.n. = sample name; s.t. = sample type

10.4.2.2 The role of eJay in supporting the interactions

The software graphic, arrange page was considered as one of the most defining features of eJay as it allowed participants to 'see' the compositional structure. It is considered that this encouraged lengthier verbal discussions, particularly when compared with the previous keyboard study. Consequently, it was considered that eJay's visual interface allowed participants to reach deeper levels of intersubjectivity, which appeared to reduce the need for continuous questioning as the technology provided an important scaffold for the interactions.

For example, in Sequence 10:3, musical extensions were developed from the suggestion presented in Line 37, to 'keep the beat going'. Prior to this suggestion, participants had tested out different samples, arranging them in different ways to see how they sounded. What does and does not work was negotiated not only verbally but also through listening to how the sample sounded. This was evaluated either verbally with a supportive utterances ('Yeah', Line 22), or with an 'um', or non-verbally with a nod (Line 23) or eye contact with the other partner that indicated that they all liked the sound. This type of negotiation was possible because all participants shared the visual, graphic interface and were aware of all musical decisions that had been made. In this way, the visual interface reinforced what participants were hearing and talking about.

Additionally, ideas such as the utterance 'What about chucking it there?' (Line 29; pointing at the interface) were again supported and understood via the visual interface. As a result, communicative patterns found during the music-making process were subtle and less dependent on producing reasons or counter-arguments. For example, utterances such as, 'Right, to something else now' (Line 25) and 'I reckon we need to keep the beat going' (Line 37) were important musical suggestions, which were introduced to the group without further explanation.

However, it could also be argued that the lack of justification about new suggestions was a sign that the partners did not have the knowledge or skills to justify their decisions. This was difficult to verify, particularly because the group did not request such justifications and seemed satisfied with making decisions based on how the composition was sounding (see Line 17, 'Meaty mix', and Lines 20-22 where all participants agree by saying 'Yeah' in relation to what they have listened to, which suggests that they were in harmony and agreement with each other). Thus, it would seem the music and the visual interface played an important role in supporting the forms of co-construction achieved in this study.

Sequence 10:3: eJay *School 1, Group 3, Triad: Shared Understanding*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
12	1	J2	S1	(Pointing) put one, just go on a few, not there to see what is (J1 has the mouse, scrolls through samples)
13	1	T	S1	Don't have a break (to J2, i.e. don't have gap between samples)
14	1	J2	E1a	No, we're just testing which ones we want
15	1	T	E1a	Put it all together (i.e. have no gap between samples)
16	1	T	S1	Now you want that one, and that one and then that one
17	1	J2	EM1	Meaty mix (referring to the composition that they have so far constructed)
18	2	J2	S1	No just have one of them, the first one (in ref to the samples that J1 has placed on the edit page)
19	1	T	E1a	No put 'em all together and see what they sound like (listen to the composition)
20	1	T	SUP1	Yeah (referring to what they have listened too)
21	1	J1	SUP1	Yeah (referring to what they have

				listened to)
22	1	J2	SUP1	Yeah (t.t.)
23	1	J1	SUP1	Oh yeah (nodding also in agreement)
24	1	T	EM1	That's working (J2 laughs)
25	1	T	S1	Right, to something else now (completed the first piece of composition, now searching for new samples)
26	1	J2	S1	Keep them (i.e. keep the samples they have so far used)
27	1	J2	E1b	Yeah keep them all, keep them all
28	1	T	E1a	Right go to voice, I bet that would be funny (J1 clicks on vocal page)
29	1	J1	Q	What about chucking it there?
30	1	J2	SUP1	Yeah (this is done, then all burst out laughing)
31	1	J2	S1	Take that off (i.e. the 'calling for your love' sample, J1 clicks on new samples)
32	1	J2	E1a	Oh my god that's funny (sings sample 'here we go') this is funny (listen to sample again, T and J2 sing along with sample)
33	1	J1	Q	How about this? (moves sample a bit, so that it's in better position)
34	1	J2	A	No, we don't want it (mocks singing it, J1 plays the sample again)
35	1	T	EM1	Yeah that works (t.t.)
36	1	J2	EM1	That does work, we need (t.t.)

37	1	J1	S1	I reckon we need to keep the beat going (t.t.)
38	1	J2	Q	Yeah, what one though?
39	1	J1	Q	Do we want that beat?
40	1	J2	E1a	Yeah, just get that beat from there, just get that beat all the way across (J1 moves vocal sample on the arrange screen)

Note: t.t. =talk together; s.t. = sample type; s.n. = sample name

10.5 Discussion and recommendations

The aim of this study was to further investigate how participants produced a meaningful context when collaboratively creating music, in a formal, school setting, using eJay sampling software. The main research questions addressed were:

1. What kinds of dialogue did the young people engage in when working together using eJay during a typical school music lesson?
2. How did eJay influence the creative, collaborative process?

The following sections summarise the study's main findings, relating them to this thesis's overall debates and discussing possible recommendations for future research in this area.

10.5.1 Characteristic features of the young people's dialogues and how they achieved a shared understanding of the task

Previous studies conducted within classroom-based collaborations on science tasks have typically shown that suggestions, positive support and extension type talk were important for collaboration (Kaartinen & Kumpulainen, 2001; Kumpulainen & Mutanen, 2000; Kumpulainen, Salovaara, & Mutanen, 2001; Van Boxtel, 2000). The present study found musical suggestions (S1); musical extensions (E1a) and positive support/agreements (SUP1) were the most frequently occurring types of dialogue. As many researchers have noted, the presence of suggestion and extension types of talk indicated that participants were successful in co-constructing and reaching a shared understanding of the task (Kumpulainen, 1996; Kumpulainen & Mutanen, 1999; Van Boxtel, 2000).

However, on closer examination of larger sequences of talk, it would seem that, within eJay-based music collaborations, the characteristics and function of the talk was different to that found within the literature on classroom-based logical-reasoning types of talk, particularly those studies that have focused on the importance of logical-deductive reasoning as exemplified by Mercer and colleagues' exploratory talk (Mercer, 1994; Mercer, Wegerif, & Dawes, 1999). Research from this perspective discusses how critical thinking skills, logical reasoning, argumentation and justification are typically considered the most productive means of learning. However, extended sequences of logical reasoning were not evident in the present study's dialogues, particularly as questions and disagreements were not the most frequent types of talk to occur in this setting. Why this is so may be due to the type of thinking skills employed when working on computer-based music tasks. During music making, the emphasis is more on divergent thinking where the construction of a variety of ideas is more productive than convergence to a single 'correct' solution to a problem. For this reason, it would seem that, when working on creative tasks, participants do not necessarily have to argue explicitly and justify their choices or ideas. Instead, thinking is more divergent, with the emphasis less on closure and problem solution and more on problem exploration and discovery.

This was best demonstrated in the sequences of talk that focused on how the participants achieved and negotiated their ideas and created a meaningful and shared understanding of the task. Solutions were reached through complex and interconnected media of verbal dialogue, music, and non-verbal action (such as the active manipulation with the mouse of the compositional structure, or participant agreement and pleasure with a sound as shown by a smile or head bob). Consequently, within computer-based music settings, agreements and decisions are reached not just verbally but also through sound and non-verbal means. Judgements were made on whether something sounded good or not without extended justifications or argument-based discussions.

In this respect the talk was characteristically different from that found within the aforementioned classroom-based science studies, particularly as participants did not engage in extensive logical reasoning and argumentative types of discourse. However, this did not make them any less productive or unable to co-construct ideas and achieve intersubjectivity. Instead, in the setting examined the talk functioned as one medium through which intersubjectivity was reached, and the verbal dialogues produced were the explicit devices used to supplement the creative flow of ideas.

To further explore this, future research in this area would benefit from examining the nature of participant dialogues using eJay in other settings. This would shed light not only on the contextual features that influence young people's creative processes but also lead to a better understanding of the compositional process when using eJay. The following study presented in this thesis directly addresses this issue.

10.5.2 The cyclical creative collaborative process

It was noticeable that in comparison with the previous keyboard study, the actual quality of the dialogue that the young people engaged in was richer, in that there was a greater exchange of creative ideas. One reason for this may be because they did not have to wear headphones as in the previous study, and this encouraged them to talk more. However, it is also believed that eJay played a pivotal role by providing a structured visual interface, which enabled all participants, irrespective of the instructions they received, to compose a piece of music.

The software provided the impetus for decisions about the samples, what to select, and how they sounded. Within this study there was evidence that the immediacy of the software allowed the young people instinctively, and with minimal effort, to produce music collaboratively by selecting, listening and evaluating samples and arranging them on a graphic page, on which they could visualise and discuss their work. In this respect, the graphic arrange page was one of the most defining features of eJay as it allowed participants to 'see' the compositional structure. Consequently, it was considered that eJay's visual interface allowed participants to reach deeper levels of intersubjectivity as the technology provided an important scaffold for the interactions.

Detailed analysis of dialogues also demonstrated how participants engaged in a cyclical creative compositional phases of:

- *Discovery and exploration* - searching for samples, listening to them
- *Selection and decision making* – selecting appropriate samples, developing their criteria for whether a sample should be included or not and how the composition should develop, deciding on the overall sound they wanted to achieve
- *Evaluating and refining* – evaluating what they had created, listening critically to what they have produced, rearranging samples and refining the overall arrangement.

Although similar phases of creativity were found in the previous study, in the eJay study the phases were richer and more prolonged.

This finding extends the body of work that has been carried out on creativity within music, education and the arts (see Section 5.4 on creativity within education and creativity using digital technologies), adding substantially to our understanding of computer-supported music processes. In particular, it extends Webster's (2001, 2002) definition of creativity as a twofold process that encompasses both divergent and convergent thinking. As found within this study, participants engaged in cycles of what could be described as divergent processes, such as open-ended exploration, and convergent processes, such as critical periods of listening, reflecting and editing. These periods of critical thinking functioned as points within the process where partners 'sat back' and reviewed their work, actively listening and commenting on what was going right or wrong in the composition. Although it is tempting to compare these phases to what has been called 'exploratory' talk, partners rarely engaged in extended periods of logical-deductive reasoning. In this respect, this study demonstrates how it may be possible to evaluate a piece of work critically without necessarily engaging in such modes of talk. This aspect of creative collaborative thinking processes is worth investigating further, and the following studies presented in this thesis address this issue.

10.6 Final conclusions and next steps

In sum, the research indicated that the young people in both school settings were engaged in complex dialogical and multimodal (linguistic, musical and gestural) interactions in which they actively appropriated the available technology to create and refine their compositions. eJay facilitated this experience by providing the young people with the opportunity to become creative, collaborative music-makers and producers. The 'click, drop and drag' approach to sample selection and arranging afforded immediate modes of musical composition, while the playback feature allowed the participants to listen to and reflect critically on what they had assembled. In addition, the range of samples stored within the software provided instant source material, analogous to a painter's palette, from which they could develop their compositional ideas. In sum, eJay supported and guided the ongoing processes of production, evaluation and redesign, in which the young people were continuously communicating, and evolving and defining their music ideas. However, while most of this chapter has focused on the positive influences of eJay, it is also worth considering whether it constrains the creative process, and the following chapter attempts to address this imbalance.

As there has been relatively little work carried out on the actual processes young people engage in when composing using computers in schools, the findings presented in this study are relevant. From the study it was clear that software based on popular music such as eJay can provide a supportive environment in which young people can successfully engage in semi-structured composition tasks.

In addressing this thesis's overarching research questions of context and creativity, it would be interesting to pursue what kinds of interactions evolve when there is no particular task instruction and what kinds of creative process are engaged in when the young people are in a different, more informal task setting. It would also be interesting to explore in more depth the 'exploratory' phase of the creative process where young people try out ideas and see what works best. As the sequences of dialogue highlighted in this chapter showed, these phases of problem finding and discovery are central to the ongoing creative process and consequently merit further investigation. The following chapter addresses these questions.

11. An exploration into young people's creative, collaborative compositions using eJay in a non-formal community-centre setting

11.1 Introduction

The study reported in this chapter continues to explore young people's creative collaborative process when composing music using eJay, through examining their interactions when working together in a non-formal, community-centre setting. As in the previous chapters, the study continues to examine how different aspects of the context such as the technology and setting influence the young people's creative collaborative processes. Of particular interest was how 'try and see' exploration, problem finding and solution phases and the technological constraints or limitations of the software influenced the creative process.

11.1.1 Non-formal setting

Outside of formal school settings, young people interact with a growing range of multimedia-based technologies from television to computer games, from the internet to mobile telephones (Green et al., 2005; Prensky, 2001).

In using such technologies, young people simultaneously use various modalities (visual, musical, written, etc.), becoming both the consumers and producers of multi-literate texts (written, aural, visual texts). The popularisation and commercial availability of computer-based music editing and sampling software means that anyone who is interested and has the finance can record and manipulate their own musical and audio material. Such access has meant that young people have greater opportunities to become producers of their own musical compositions, styles and innovations out of school settings. A second issue that therefore arises from investigating computer-based musical collaborations is the need to examine how young people use music technologies outside of school.

However, as discussed in the opening theoretical chapter (see Sections 2.4 and 2.4.1), Sefton-Green (2003) notes how difficult it is to distil what constitutes 'learning' in non-formal settings, particularly as it raises a provocative set of questions about what might be learnt outside the formal curriculum. As many researchers have noted (Marsick & Watkins, 1990; McGivney, 1999; Sefton-Green, 2003) both formal and non-formal learning can occur in the same space and defining the differences between them can be extremely complex. Bearing this in mind, this study aims specifically at investigating how young people collaborate and create music together using eJay within a non-formal, community-centre setting.

11.2 Research questions

1. What types of dialogue were invoked when collaborating on eJay in a community-centre setting?
2. In the exploratory 'try and see' creative phases, what kinds of interactions occurred?
3. Did the technology limit or constrain the creative collaborative process?

11.3 Method

11.3.1 Setting

The study was carried out during Boys' and Girls' Brigade club meetings at a community centre in Milton Keynes, UK. The Boys' Brigade (BB) and Girls Brigade (GB) organisations are worldwide Christian Youth Organisations, similar to the Scouts, and offer a wide range of activities including games, crafts, sports, Christian teaching, music and holidays to young people aged 13-16 years. The Boys' and Girls' Brigade groups participating in this study met once a week at the local church community centre.

In the Boys' Brigade (approximately 15 members in total), activities were facilitated by two male leaders and included indoor football and car track racing. In previous years the Boys' Brigade also had a marching band, which some of the participants in this study had taken part in. Therefore, there was some history of musical activity within the Boys' Brigade. However, the marching band was no longer running at the time this study was conducted.

Two female leaders facilitated the Girls' Brigade (approximately 10 members in total). The Girls' Brigade activities included debates about various issues (sex education, career advice) and, like the Boys' Brigade, also included training weekends and days out.

11.3.2 Task

The rationale for using eJay software was provided in the previous study (Chapter 10). The previous study found that within school settings eJay was a popular and user-friendly tool. For these reasons it was believed that eJay would be applicable and appealing to the Boys' and Girls' Brigade groups as they were of a similar age to the participants studied at school.

A computer with eJay installed and external speakers was set up by the researcher in the community centre, in a separate room from the main Brigade activates. During the Brigade meetings, participants would come to this room, where they were greeted and introduced to the researcher and presented with the task.

For the task, participants were offered versions of eJay (Rave, Dance and Hip hop on CD-ROMs) and asked by the researcher to choose which one they would like to use. When participants had made their choice, the researcher launched the chosen version of eJay and proceeded to explain the task. The researcher set the task instruction, which was to 'jointly compose a piece of music using the eJay samples as they wished'.

As noted in the previous chapter, providing the participants with a choice of Rave, Dance and Hip hop eJay was not seen as a problem because, although the styles of music are different, the interface, design and 'click and drag' application remain the same for all styles.

When the participants were clear about what they had to do, the researcher then gave a short demonstration (for script, see Appendix 9) to each group on how to click, play, listen, drag and place samples on the arrange page, as well as how to rewind, fast-forward and play their compositions. The demonstration acted as a short informal training session. Participants were also encouraged to ask questions for clarification at the end of the training session, so as to ensure that they all understood how to use the software. The researcher remained in the room with the participants during the compositional period and on occasion answered participants' questions about certain functional aspects of the program. At times the researcher had to leave the room to check that the other participants were ready or to check how much time was left with the leaders of the Brigade.

11.3.3 Participants

Before the sessions took place, letters outlining the study and when it was taking place were sent to the Boys' and Girls' Brigade leaders (see Appendix 8). As the researcher was not allowed access to individual participant's addresses, the leaders forwarded a letter outlining the study and asking the young people's parents for their consent to participate in the study. None of the parents objected to their children being involved in the study. The leaders, who arranged for the dyads to go to the researcher's room, made the final selection of participants. The researcher therefore had no control over the actual selection of participants, as it was up to participants and their parents when asked by the leader whether they wanted to be involved or not. The researcher also asked, prior to each session, whether the participants were happy to take part. On the day of selection, only one individual did not want to take part.

Between the Boys' and Girls' Brigade, a total of 9 dyads (18 participants, mean age 13.8 years) took part in the study. In both Brigades, participants were accustomed to working in pairs and groups. The Boys' and Girls' Brigade dyads were treated as one data set; that is, within this study the findings are reported simultaneously and no comparisons were made between the groups. This decision was based on the similarities in participants' ages, school year and task instructions. In the Boys' Brigade group, one participant (Participant N) was involved in the study twice, in Dyads 2 and 5. This situation occurred because the Brigade leader was keen that those who had agreed to participate in the study had a chance to do so. As the numbers in the Boys' Brigade were uneven, the doubling up of participants occurred. This situation was accounted for as best as possible within the analysis.

Taking both groups into account, the overall mean age was 13.7 years and overall time composing was 26.17 minutes (see Table 11:1).

Table 11:1: Community centre eJay, *Boys' & Girls' Brigade: Overview of task and participants*

	Pair	**eJay**	**Mean Age**	**Task Time In minutes**
Boys' Brigade	1	Dance	15 years	28.50
	2	Hip hop	12.5 years	23.26
	3	Hip hop	11.5 years	22.50
	4	Dance	14 years	31
	5	Dance	13 years	25
Girls' Brigade	6	Dance	14 years	24.40

7	Dance	16 years	32
8	Dance	14 years	21.23
9	Dance	missing	24.05

11.3.4 Procedure

The study took place over a two-week period and was carried out during regular Boys' and Girls' Brigade meetings. During each session, participants' interactions were recorded on video. The same video camera set-up, as outlined in the previous study (see Section 8.5.1) was used, with the aim to capture the activity as naturalistically as possible and with minimal interference. The researcher also took observational notes during the session. On occasion the researcher received questions from a participant regarding some of the functions of eJay, such as whether they could make pre-programmed samples sound louder. Although the researcher answered these questions, the aim was not to interfere with the activity and to capture it as naturalistically as possible.

11.3.5 Analysis of verbal dialogues

The coding scheme, developed for the thesis, was also applied to the data from this setting. The same software (MEPA and SPSS) was also used for entering and analysing the data. For a detailed account of the development and rationale of the scheme, see Chapter 8, and see Appendix 7 for the short version of the coding scheme.

11.4 Results

11.4.1 Quantitative analysis - descriptive statistics

Table 11:2 represents the percentage proportion of each category of talk spoken across all the dyads. The results indicated that in the Boys' and Girls' Brigade community-centre setting (n=9 dyads), musical suggestions (S1), musical extensions (E1a), questions (Q), and agreements (SUP1) were the most frequently occurring categories of talk. As in the previous studies, the average for each code was calculated and subtracted from the mean (5.55). The categories that fell at or above the SD value of 7.37 were considered the most significant types of talk (see Figure 11.1). From this it was found that musical suggestions (S1), musical extensions (E1a), questions (Q), and agreement (SUP1) were the most significantly occurring types of talk. This finding demonstrated that partners were communicating in a style indicative of good collaboration, producing new musical ideas, building and extending them and supporting each other. Importantly, questioning (either by challenging each other or asking for clarification about the others position) during the compositional process was frequent, indicating that partners were exploring each other's viewpoints in depth.

It was interesting to find that similar types of talk occurred in this non-formal setting as in the previous school eJay setting. Given the differences in setting, participants, instructions and so forth, and based on findings from other collaborative learning studies which found that the aforementioned variables should influence the type of talk (Hoyles, Healy, & Pozzi, 1992; Kumpulainen, 1996; Van Boxtel, 2000), one would have expected greater differences. From this finding, it was necessary to carry out further analysis before discussing the reasons and implications of this result.

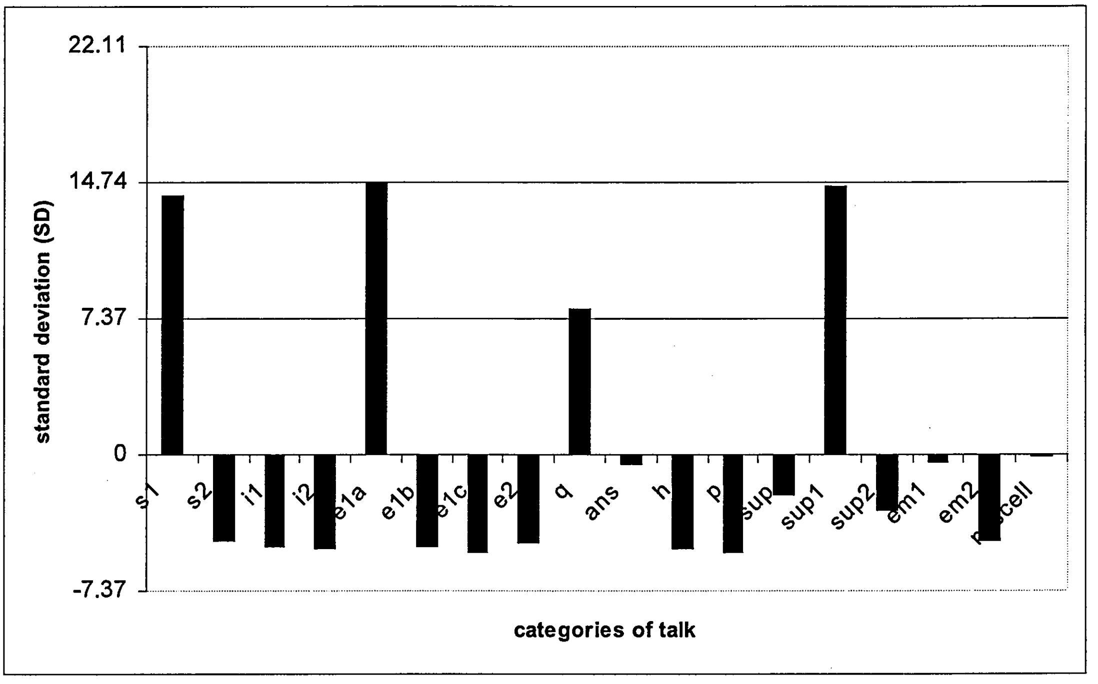
Table 11:2: eJay *Boys' and Girls' Brigade: categories of talk*

Descriptive Statistics based on proportions of categories of talk (n= 9 dyads)

Code	Minimum	Maximum	Mean	Std. Deviation
S1	13.19	27.21	19.57	5.21
S2	.24	2.13	0.86	0.67
i1	.00	2.99	0.58	1.02
i2	.00	1.80	0.47	0.56
E1a	13.95	34.07	20.27	5.79
E1b	.00	1.17	0.57	0.46
E1c	.00	1.10	0.31	0.44
E2	.00	2.04	0.74	0.68
Q	10.68	16.48	13.40	2.11
ANS	2.47	7.87	5.07	1.80
H	.00	1.70	0.49	0.59
P	.00	.93	0.23	0.33
SUP	1.33	5.09	3.33	1.22
SUP1	14.52	24.47	20.04	3.40
SUP2	.47	5.33	2.58	1.72
EM1	1.47	9.32	5.13	2.53
EM2	.00	1.60	0.90	0.51
MISCELL	2.56	8.77	5.46	1.64

Figure 11:1: eJay *Girls' and Boys' Brigade*

Most frequently occurring types of talk (mean 5.55; SD 7.37; n=9 dyads).



11.4.2 Qualitative and interpretative analysis

The descriptive data were used as a springboard to further qualitative analysis. This was carried out in order to address in more depth the research questions, in particular whether the setting influenced the participants' interactions in ways not picked up by the coding scheme.

11.4.2.1 Did the non-formal setting influence participant interactions?

Despite the difference in this setting from the previous formal, school-based setting, fewer differences were found than expected. Similar types of dialogue occurred most frequently; namely, musical suggestions (S1), musical extensions (E1a), questions (Q), and agreements (SUP1). This finding has implications for work which has been carried out within collaborative learning, particularly research that found the task setting and instruction influences the learning process (Bennett & Dunne, 1991; Kumpulainen, 1996; Kumpulainen & Kaartinen, 2000; Van Boxtel, 2000). In this study, this was found not to be the case. It is possible that this finding may be due to the type of task investigated within this thesis and the technologies used. This issue will be addressed in greater detail in the discussion section. However, before embarking on this it is necessary to focus in more depth on some of the characteristic features of this setting and how they can shed further light on the issues of context, creativity and technology, as examined in this research.

11.4.2.2 The creative collaborative process – the importance of exploration

As in the previous chapter, musical suggestions and extensions were key indicators of how the partners engaged in the creative processes of selecting, arranging, editing and refining their compositions.

The study therefore provided further evidence of the cyclical nature of the creative process and how its characteristically different phases are interlinked and interdependent. One recurring phase of the creative process, which has been discussed in the previous chapters, is the exploration phase, where partners are initially discovering the parameters of their ideas and contributions. This phase is characterised by what could be considered as 'try and see' modes of exploration, where partners initially try out sounds and samples as they 'weed out' the possible directions that their composition could take. One way to interpret this phase is through the lens of problem finding and/or discovery, as partners discover sounds and find ways to develop their composition. As this research has shown so far, this aspect of creativity is crucial and is believed to differentiate creativity characteristically from other endeavours. Through the process of exploratory 'try and see' approaches and accidental mishaps, partners reach small 'eureka' breakthrough moments, from which the framework for the next step of their composition can emerge. As such phases are so important, they warrant further investigation. The following sequences attempt to highlight this aspect of the creative process.

For example, in the Sequence 11:1, partners selected and evaluated what samples they were going to use. Partner M introduced the idea to use effect type samples by clicking on these types of sounds. The effects were considered 'wicked' (Line 116) and they chose other samples that 'sound good' (Line 119) and complement the 'wicked' sample. Participant M suggested that these samples would be appropriate to place at the 'end' (Line 119) of the composition. As a result of this suggestion, participants began to debate whether they were the most appropriate samples to use at the 'end' of the composition. Participant D then pointed out that they need only 'two small' samples (Line 120), that were not 'too high' (Line 122), to end with. However, the current samples were considered 'too high' (Line 122) and although it might have been possible to use 'loads of them' (Line 123), they were tested along with other samples (i.e. the 'purple' samples, see Line 134). As demonstrated in this sequence, the selection of samples and their subsequent arrangement was constrained by previous choices, as well as by a continual exploratory, 'try and see' approach that involved listening to what the samples sounded like, trying them out, and seeing whether they worked in relation to the current arrangement.

*Sequence 11:1:*eJay *Boys' Brigade, dyad 4: try and see*

Line	**Turn**	**Participant**	**Code**	**Transcribed discourse and**

No.				notes
114	1	M	S1	Some claps, now yeah,
115	2	M	Q	What are all these? (clicking into effects)
116	1	D	EM1	Oh wicked ...
117	2	D	S1	Go down again, go down
118	2	D	SUP1	Yeah (to some symbol crashes)
119	1	M	EM1	Sounds good, the end (ref to sample)
120	1	D	S1	Only two small ones (that is get two small samples)
121	1	M	SUP2	No
122	1	D	E1a	They're too high
123	1	M	Q	Should we have loads of them?
124	1	D	Q	You want to hear them?
125	1	M	SUP1	Yeah, um (moving over some samples to fit them in, put them in)
126	2	M	X	xxx xxx (effects, searching)
127	1	D	Q	What these ones too?
128	1	M	A	Ah, its doesn't matter, its up to you if you want them
129	2	M	Q	Do you want some?
130	3	M	X	xxx
131	1	D	A	No, just got xxx (pointing to other samples, M continues clicking and listening to several samples)
132	1	M	S1	This one, yeah (finding one he likes)
133	1	D	SUP1	Yeah...

134	2	D	S1	Some more of the purple things (pointing)

Note: s.n. = sample name; xxx = non-transcribed word; xxx xxx = non-transcribed sentence

This exploratory, 'try and see' method was not just applied when selecting samples but also when trying out whether something worked well, as evident in Sequence 11:2, where participants 'try' (Line 222) to see if something works by rewinding the composition and evaluating what they have created. On listening to the composition they realised that they needed to move some samples 'somewhere else' (Line 226). This period of critical listening led to further ideas, which constrained the creative process by allowing the participants to decide on what to do next (Line 229, 'Yeah...and then we have something like this, one').

Thus, the creative compositional process was driven in part by periods of exploration during which the appropriate samples were derived and discovered (see Sequence 11.1 for an example) and by periods of reflective listening and evaluations as demonstrated below in Sequence 11:2. Through such periods the foundations of the compositional structure developed. This in turn formed a baseline from which the composition could 'hang' and from which other samples could be judged and selected.

Sequence 11:2: eJay *Boys' Brigade, dyad 2: try and see*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
222	1	J	S1	Let's try
223	2	J	Q	What are you doing?
224	1	N	A	Going back (that is, rewinding to

				where they were)
225	1	J	SUP1	Oh yeah (listen)
226	2	J	S1	I think that should be somewhere else (t.l.)
227	1	N	SUP1	Yeah (t.l.)
228	1	J	E1a	I think that should be there
229	1	N	E1a	Yeah ... and then we have something like this, one (tries to move vocal sample. Another participant walks into the room at this point, Re asks him to leave)
230	1	J	S1	Let's try it
231	1	N	SUP1	Yeah

Note: s.n. = sample name; xxx = non-transcribed word; xxx = non-transcribed utterance; t.l. = talking while listening

The exploratory 'try it and see' (Line 215) mode was again utilised in the Sequence 11:3, as partners discovered what samples would best carry the beat. In working through and testing ideas, further suggestions were made such as to use a 'little bit of scratchin' (Line 216). However, this kind of effect was not possible on the dance eJay software that they were using. Despite this limitation, participants' creative processes were not hindered and alternative suggestions were made, such as to add some more 'rhythm' and 'keep on' samples (Lines 225 and 226 respectively). For this group and for many others, what was most important within the process was to find 'something decent' (Line 223) that was to find sounds that sounded good and fitted into their compositional framework.

Sequence 11:3 eJay *Girls' Brigade, dyad 8: try and see*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
206	2	N	S1	Right we need to add something
207	1	T	S1	Yeah you might need to take one of the clicks off, it's up to you
208	1	N	Q	You, what you want?
209	1	T	A	Leave it if you want
210	1	N	E1a	Unless we move that over there, coz then it keeps going
211	2	N	SUP1	Yeah
212	3	N	Q	And do we want to carry that one?
213	1	T	EM1	That's good, that one
214	2	T	Q	We got mother ship xxx (s.n.)
215	1	N	SUP1	Ah ... try it, try it and see
216	1	T	S1	A little bit of scratchin' I expect, but there you, you (i.e. a little scratch would be good)
217	1	N	E1a	I don't know, I don't know if you can do it with this one (i.e. you can't do scratch with this type of eJay)
218	1	T	X	xxx xxx
219	1	N	SUP2	em, don't know, don't think so
220	1	T	X	xxx
221	1	N	S1	Bit more, over here, after that (searching for sample) ... look
222	1	T	SUP1	Yeah
223	1	N	S1	We want something decent (i.e.

				they need decent sound)
224	1	T	S1	'In my land', xxx (s.n.)
225	1	N	S1	'Rhythm' (s.n. they are looking for something decent and just calling out names)
226	1	T	S1	'Keep on' (s.n.)

Note: s.n. = sample name; xxx = non-transcribed word; xxx xxx = non-transcribed utterance

11.4.2.3 How eJay supported and constrained the creative process

As evident from the above transcripts, similar to the previous school setting, eJay was an important mediating influence in that it provided not only a supportive interface allowing participants to work together but was also a means through which participants could express their musical ideas.

This was demonstrated in the above dialogues where the eJay samples were used as a source for musical expression, while eJay's visual interface supported partners in achieving common ground and mutual understanding. Many of the participants in this study had never used eJay before, and the immediacy of the software and its ease of use were evident in how quickly all participants picked it up and began to create music. The visual arrangement screen provided a quick, easy to use, 'show by doing' platform through which ideas could be demonstrated and tested, while the actual physical manipulations of clicking, dragging and pointing via the mouse allowed samples to be placed and arranged in an immediate and responsive manner. In sum, as with the previous study, this study provided further evidence of how eJay's visual interface supported the creative and collaborative interactions.

However, in some cases the technology also constrained participants compositional process. For example, in Sequence 11:4 the participants wished to make a sample sound 'quieter' (Line 128), so that they would fade into the previous sample. They asked the researcher if this was possible. However, the technology did not allow for this, as the samples are all pre-programmed to sound a certain way. Despite this technological constraint, participants were able to think beyond the limitation of the software. Their solution to the problem was to rearrange the samples so as to create the musical effect they wanted (see Lines 135 and 136 respectively, where they discuss different scenarios).

Sequence 11.4 shows how participants thought through the problem and how they came to the decision to place samples at the 'top' (Line 136) of the composition and then listen to their new arrangement, deciding that it 'sounds better the way it is' (Line 141). This led to a new idea about how the 'middle' of the composition would sound (Line 142). Again, this demonstrates not only how the participants worked around some of the constraints imposed on them by using the eJay software, but also how the visual interface allowed them to discuss these problems and solutions by clicking on samples, pointing to samples and illustrating parts of the sequence with the mouse. In this way, eJay as a shared visual musical space allowed compositional problems to be identified, illustrated and discussed in ways that were not possible when working on keyboards or more traditional musical instruments.

Sequence 11:4: eJay *Girls' Brigade, dyad 1: technology's influence*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
128	2	V	Q	Will, will we be able to make this bit more quieter...or no? (asking Re question)
129	1	K	SUP1	Quieter (t.l.)
130	1	Re	A	No, I don't think that'll, fade it
131	1	V	E1a	It's probable because there's two isn't there, so (referring to how there are two samples together)
132	1	K	SUP1	Yeah
133	2	K	X	xxx (clicking, continue to play)
134	1	V	i1	It's loud
135	1	K	S1	Wonder what will happen if you put them all on that end, put all there
136	1	V	E1a	Even if you put, even, there one and at the top as well (pointing)
137	1	K	X	xxx xxx
138	1	V	SUP1	Yeah, that one
139	1	K	SUP1	Right then, there (rearranging the samples)
140	1	V	SUP	Em
141	1	K	E1a	It sounds better the way it is, slightly (listening to the section, then stops listening and begins searching for new samples)
142	1	V	E1a	I bet that could be like, for the middle, something like that

				(pointing)
143	1	K	E1a	Yeah, sort xxx here (moving mouse)
144	1	V	SUP1	Yeah

Note: t.l. = talk while listening; s.n. = sample name; xxx xxx = non-transcribed utterance

Similarly, Sequence 11:5 highlights another of the functional constraints that participants encountered when using eJay. The participants wanted to manipulate the samples more and extend them, rather than have them play for only a fixed amount of time: 'The only problem with them is that, they go, then just stop' (Line 330). However, as the samples in eJay were pre-recorded such functions were not possible. In order to extend the composition they had to find an appropriate sample.

This was achieved as both participants suggested using the 'strings' sample (Line 338) or to 'just leave it ...' (Line 339). The participants followed these ideas, trying out other samples to see if they worked (Lines 342-3). From this period of 'trying and seeing' and listening to various samples, the participants found a sample (Line 345) that fitted into the existing structure and produced the fading effect they wanted. As with the previous sequence, participants had to think beyond the technology in order to solve their compositional problems. In doing so they rose above the functional constraints imposed by the pre-programmed samples.

Sequence 11:5: eJay *Girls' Brigade, dyad 1: technology's influence*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
330	2	N	E1a	The only problem with them is that,

				they go, then just stop, xxx xxx
331	1	T	SUP1	Yeah
332	1	N	E1a	You need something to carry on, a little small one
333	1	T	SUP1	Just carry on
334	1	N	E1a	A real little one, then we can put one there
335	1	T	SUP	Um (looks at T)
336	2	T	SUP1	Up to you (mumbles)
337	1	N	E1a	There's goin' to be, more space between that
338	1	T	S1	So these strings (suggesting they use string sample)
339	1	N	S1	xxx or should we just leave it, so do you like that one the water thingy or we could just have an extra
340	2	N	SUP1	Hang on there
341	1	T	SUP	Um (referring to the sample)
342	2	T	Q	Will that fit in there? (Trying out samples to get the little one they want)
343	1	N	A	No (clicking and searching for sample that fits in)
344	2	N	E1a	Same size, oh on, it's not (referring to samples she is scrolling through)
345	3	N	S1	That one (referring to new sample)
346	1	T	SUP1	Yeah (aggress)
347	1	N	SUP1	Ok (clicks on sample. Listen to the new sample mix)

Note: t.l. =talk while listening; s.n. = sample name; xxx xxx = non-transcribed utterance

11.4.2.4 How participants' wider musical experiences were invoked with their dialogues and influenced their creative processes

Although this study did not specifically set out to explore how participants' cultural and musical experiences influenced their compositional process, some good examples of this emerged from this data set. Similar examples were found in the first keyboard study, where, for example, participants' film and community music playing experiences influenced the kinds of compositions they created. Although such examples are a small part of the overall process, they are interesting and warrant attention as they provide an insight into the cultural experiences that influenced the participants' creative process.

Within the current study, there was explicit evidence of participants invoking their knowledge of popular music styles and culture. This is not surprising for two reasons. First eJay utilised popular styles of music and so connections to this type of music would naturally be made. Second, it would also appear that participants' music-listening practices were invoked within the compositional process. For example, Sequence 11:6 and Sequence 11:7 demonstrate how participants made reference to popular music acts, such as 'Fragma', a techno band (Sequence 11:6, Line 203) and 'Britney'; that is, the pop-chart singer Britney Spears (Sequence 11:7, Line 64). Both these examples see how the participants linked music they listened to, such as dance techno groups Fragma and pop star Britney to the style of music they were creating with eJay.

Sequence 11:6: eJay *Girls' Brigade, dyad 8: participants' musical experiences*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
201	1	N	i2	This sounds like, sounds like ahmm
202	1	T	E1c	I know what you're thinking
203	1	N	E1c	Fragma song (techno band)

Sequence 11:7: eJay *Girls Brigade, Dyad 3: Participant' musical experiences,*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
64	2	L	i2	Definitely Britney there (pointing to sample)
65	1	P	SUP	Mmm

Sequence 11:8 illustrates participant N2's excitement at the sound quality of eJay. The software markets itself in this way using terms such as 'production polish'[12], to highlight how it allows the user to create professional-sounding music. Since this research was conducted, eJay has gone from strength to strength. Its current online site has a large section devoted to 'artists', with facts on famous artists, information on how they make their own music and highlights from the online community of eJay artists, the young people who are making interesting tracks using the software (see http://www.ejay.com/artists/). The company behind the software (Empire Interactive plc) thus makes strong links between existing musical practices and famous artists,

[12] http://www.ejay.com/software/product.asp?psj=8C4A81CC-514E-4ED4-91AC-0CED787C1248. Retrieved 7 February 2006

advocating how the software can be a stepping stone to the commercial world of music making.

This aspect of the software has clear motivational value, and participant N2 explicitly linked his own music-making practice to that of professional musicians. Participant N2 wanted to know whether it would be possible to release what they were making into the charts, and even considered the length of the track, saying that it had to be 'three minutes long' (Line 123) to be played on radio. This utterance not only expressed how much fun and enjoyment participants had when working on eJay but also how participants linked their own work to more professional music settings. This illustrated one of the benefits of eJay in that it allowed participants to create music that they were proud of and that for them sounded like the 'real thing'.

Sequence 11:8: eJay, *Boys' Brigade, musical references, dyad 5*

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
121	4	N2	i2	Are we allowed to release these things in the charts? (laughs, t.l.)
122	1	N1	Q	How long is it? (referring to the end section of composition & pointing to it, t.l.)
123	2	N1	E1c	If we need, we can make it and goin' to release it, we need to make three minutes long (i.e. you need to make it three minutes long to release it)
124	1	N2	EM1	I think it's very good (t.l.)
125	1	N1	EM1	Very good (t.l)

t.l. = talking while listening

11.5 Discussion and recommendations

The aim of this study was to investigate how participants collaboratively created music using eJay in a non-formal, community-centre setting. Of particular interest were the following research questions:

1. What types of dialogue were invoked when collaborating on eJay in a community-centre setting?
2. In the exploratory 'try and see' creative phases, what kinds of interactions occurred?
3. Did the technology limit or constrain the creative collaborative process?

11.5.1 The dialogue and setting

In relation to the types of dialogue, the quantitative analysis indicated that musical suggestions (S1), musical extensions (E1a), questions (Q), and agreements (SUP1) were the most frequently occurring types of talk. This indicated that partners were communicating in a style indicative of good collaboration, producing new musical ideas, building and extending them and supporting and questioning each other in this process (Buckingham, 2000; Kumpulainen, 1996; Van Boxtel, 2000).

Additionally, the frequency of the above types of talk is interesting because very similar types of talk occurred in the previous school eJay study.

This leads to further questions about the links between the settings. To better understood this, it was useful to return to Sefton-Green's (2003) formal/non-formal continuum of settings. In relation to this thesis it is best to consider the formal eJay school setting as being at one end of this continuum and the Brigade, community-centre setting as being in the middle, more similar to semi-formal settings than completely non-formal settings such as at home in the family. In relation to how the settings were *organised*, however (Sefton-Green's other continuum), the differences may be less, as in both contexts a task was set, using the same technology and within a relatively confined space. In this respect, it could be argued that the community-centre setting was a semi-formal setting, but organised in a formal-like way. However, even taking this into consideration, one would have expected a greater difference in the patterns of interaction occurring. What is clear is that further work in this area needs to be carried out. The next chapter in this thesis explores this further.

What was also interesting about the community-centre setting was that although there was no predefined structure given, all the participants were successful in completing the task, no one got stuck or felt they could not do it and all participants seemed to enjoy the experience. This suggested that eJay could support inexperienced users to create music when they were given very open-ended compositional task instructions. Why this is so was believed to be due to the design of eJay. The software provided participants with a clearly laid out interface. Participants clicked and dragged various colour-coded samples onto an arrange page, from which they could easily remove and erase them. Other functions such as rewind, play and stop were easily identifiable in that they are similar to functions found on tape recorders and video players. It was considered that because of the software simple, colourful layout and lack of complicated functions, it provided a scaffold for users by means of which they could explore their compositional ideas. In sum, eJay provided a framework for shared compositional work, which allowed participants to work together even when they had little or no prior experience of the software and were given a very open-ended task.

11.5.2 Further explorations of the creative collaborative process

In learning to work with eJay, participants had to explore its limits and potential. Interestingly, the software's technological constraints also afforded new opportunities for participants to engage jointly with problems and discuss new possibilities and solutions. Essential to creative expression is learning the possibilities and limitations of the tools you are working with and exploiting the trade-offs between both so that you can maximise the full potential of the tools and materials you are using. In this study, the limitations of eJay were examined and how participants overcame these constraints in order to achieve their goals. In achieving this, evidence was again found of the importance of exploration as a key aspect of creativity.

As noted in the theoretical chapter on creativity (Chapter 5), the process of problem finding and discovery was considered a central tenet of creativity (Amabile et al., 1996; Csikszentmihályi & Getzels, 1970, 1971, 1973). From this perspective, the creative process is defined as the 'formation of a problem, adaptation of a method of solution, and the reaching of solutions' (Csikszentmihályi & Getzels, 1971, p.70), where the key process is the person's ability to define or formulate the nature of the problem rather than necessarily solving it. Further analysis of this particular phase of creativity showed that at different points within the compositional process different levels of exploratory 'try and see' approaches were used. This was driven by what stage of the compositional process the young people were at. For example, depending on whether they were at the start of the composition or towards the end, different problems arose, which demanded the discovery of new solutions. This led to the conclusion that the creative process is a twofold process, continually driven by both divergent and convergent thinking.

In sum, this study highlighted how complex the continuum between formal and non-formal learning is and potentially highlighted how the task organisation rather than task setting was the main influence on the interactions observed. This finding warrants further investigation and the following chapter presented in this thesis further explores this area. The current study also highlighted that the software was an important mediating influenced in the creative collaborative process, which could both support and constrain creativity. This finding led to discussions about problem finding and solution as part of the creative process and how limitations or constrains can be advantageous to the creative endeavour. In addition, the participants' references to popular styles of music seemed in some cases to further ground participant interactions and support intersubjectivity and a shared sense of the task. Although not specifically focused on, this latter point is interesting and led to questions around how participants' prior musical experiences can influence their eJay collaborations. The next study presented in this thesis further explores this area.

12. An exploration into young musicians' creative, collaborative compositions using eJay in non-formal settings

12.1 Introduction

This study further investigated the complexity of defining the difference between formal and non-formal settings. Building on the previous study, the aim was to further explore how the organisation of the task setting and participants' prior musical learning experiences influenced the interactions. The work draws especially on the research carried out on how participants' formal musical training influenced their computer-based compositions (see Chapter 5, Section 5.3). To summarise this work, it has been shown that formally trained musicians' computer compositions were judged to be less original, and that they experimented less with the possibilities offered by the computer (Folkestad, 1998; Scripp, Meyaard, & Davidson, 1983; Seddon & O'Neill, 2000). Seddon and O'Neill (2000) believe that this is due to the musicians' preconceived ideas and values about music carrying over from their training, and leading them to explore less the possibilities of the software. This study builds on the existing work by specifically exploring the differences between different approaches to music education, as outlined in Section 12.1.1 of this chapter.

In sum, in relation to the overall themes and questions addressed in this thesis, this final empirical chapter explores how young people's prior music-learning experiences can influence their eJay collaborations. In doing so, the current study addresses how particular personal relations within a task setting, such as your prior musical learning, can influence the creative process.

12.1.1 Formal and non-formal music training

Within music education and psychology, the formal/non-formal continuum has been explored in relation to how individuals learn music. For example Green (1998) distinguishes between formal and non-formal music education, characterising them relation to the settings in which they take place and the practices involved. According to Green, formal music education refers to instrumental and classroom music teachers' practices, training and education and to pupils' and students' experiences of learning and been taught, educated or trained in a formal setting. Such settings are predominately teacher-directed, where the focus is on instructional music tuition and music appreciation. In comparison, non-formal music learning refers to a variety of approaches to acquiring musical skills and knowledge outside formal learning settings.

Much of the research into the formal music education process tends to focus on classical instrumental and vocal students, at secondary, tertiary and conservatoire levels, where particular emphasis is placed on learning strategies, skills and knowledge, particularly the importance of practice, the quality of practice, and the learning of technical skills and expressiveness (Hallam, 1998, 2001; Jorgensen, 2001; Sloboda, 1996; Sloboda, Davidson, Howe, & Moore, 1996). Technical skills are those skills which allow musicians to play accurately in performances, and include motor coordination, fluency of play and perceptual skills such as pitch acuity. Expressive skills refer to the individual's interpretation and the qualitative changes they make to the piece, in timing, speed, pitch and so forth. Expressive skills are extremely important as they reveal and highlight aspects of the musical structure, which help the audience understand the music. It is the fine balance of technical and expressive skills that, according to Sloboda (1994) and Davidson (2002), are considered by those within the profession as the hallmark of a 'real' and 'gifted' musician.

The key findings from formal music learning research emphasis the importance of technical and expressive skills and the fostering of instrumental excellence (Stollery & McPhee, 2002). Although some researchers have considered social and affective influences, they tend to be measured against these musical values. For example, Davidson and colleagues (Borthwick & Davidson, 2002; Davidson & Borthwick, 2002; Davidson & Scutt, 1999) have found that the role of teachers, particularly students' relationships with their first teacher; the importance of parental support and commitment; and sibling relationships all influence formal instrumental music learning. Others have found that individual motivation and self-identity (Hallam, 1998; Ivaldi & O'Neill, 2000; O'Neill, 2002; Vispoel & Austin, 1993); positive and negative musical experiences (Stollery & McPhee, 2002); and emotional and personal satisfaction (Sloboda, 1990, 1994) influence the persons ability to learn expressive musical skills.

In comparison, within music education and psychology there has been significantly less work carried out on non-formal music learning and practice. According to Green (1998), non-formal education settings share few or none of the defining features of formal music education.

Musicians within this category generally teach themselves or 'pick up' skills and knowledge, usually with the help or encouragement of their family and peers, by watching and imitating musicians physically around them or from recordings or performances and other live events involving their chosen form of music (Green, 1998, p. 5).

In this respect, non-formal music-making practices are akin to sociocultural approaches to learning, such as Rogoff's (1990) and Brown, Collins and Duguid's (1989) apprenticeship models of learning and Lave and Wenger's (1991) idea of legitimate peripheral participation, where the newcomer, or novice learner, learns the skills and practice of the community by actively participating in meaningful, authentic learning situations. Such approaches to learning music are often linked to pop, rock and hip hop (Cohen, 1991; Rosenbrock, 2002); traditional and world music (Cope, 2001; McCarty, 1997, 1999; Oehrle, 1991); and jazz (Berliner, 1994), while formal music learning tends to be associated with classical music (Davidson & Scutt, 1999; Hallam, 2001; Sloboda, 1996).

Within non-formal music learning, the musician over time develops their 'own voice' within a particular style of music. Learning involves becoming enculturated into various music practices, through purposive and attentive listening, copying and imitating recordings; watching and imitating accomplished musicians; exchanging skills and knowledge with peers; and playing in social and group contexts, either for practice or for an audience. This is not to say that enculturation into the practice does not occur in formal instrumental learning, and there are some crossovers. However, in non-formal music learning, from the beginning, enculturation occurs through continued active participation in the style of music through copying, imitating, close watching and actively listening to expert musicians.

This process generally takes place in a peer or group context, where learner autonomy, freedom and choice are considered highly important. In comparison, enculturation into formal instrumental practices begins with the constant practice of technical skills, which is generally undertaken when alone following instruction by a single teacher. Importance is placed on notation (the reading and writing of music), theory and technical and expressive skills. Progress is measured in terms of exam results and formal assessment, and there is less autonomy and freedom as training is nearly always supervised and teacher-driven, and tasks are generally fixed and pre-designed (e.g. to learn a specific piece or scales). In contrast, in non-formal music learning, progress is seldom quantitatively measured; instead, increased participation (e.g. in a pub session) is a greater measure of success. Finnegan (1989, p. 179), in her research on local traditional folk band practices, also found that freedom and autonomy is highly regarded as bands tend to be self-organised and independent of any institution. In comparison, in formal music learning, musicians report on feeling they have less musical autonomy and freedom (Green, 1998). Furthermore, Cope (2001) found that friendship and shared taste between groups of people playing popular and traditional music was important. In interviewing traditional musicians, Cope found that a friendly, supportative and inclusive social context, where there is tolerance for all music ability, was seen as important and motivating. In addition, Cohen (1991), in her work on rock band members in Liverpool, noted that image - the impression that band members wanted to present about themselves and their identification with the lifestyles and appearances of the stars in that genre - influenced the musicians' motivation as much as the sound of the instruments and the music itself.

In sum, the key findings from non-formal music-learning research emphasise the importance of enculturation into a particular style of music through the active participation with other more accomplished musicians and peers. The social setting and culture within which this form of music learning occurs has been shown to be of utmost importance, influencing not only the continued motivation for playing and learning but also individuals' sense of freedom, autonomy and identity.

This chapter explores how this body of research, extends the understanding gained to date in this thesis, while simultaneously adding to the body of research carried out in the field, which so far has largely ignored these issues in relation to computer-based music interactions.

12.2 Research questions

The research questions addressed in this study were:

1. What types of dialogue were used in non-formal (Girls' Brigade band and music camp) settings?
2. How did the participants' prior music-learning experiences influence their collaborative and creative processes?

12.3 Method

12.3.1 Settings

Two settings were explored in this study. The first was held in a community centre where a Girls' Brigade group met and ran a band.

The second was at a summer music camp where young people came to spend a week in music-making activities.

12.3.1.1 Girls' Brigade band setting

The Girls' Brigade band sessions took place at a community centre in the Oxford area, UK. The community centre specialised in supporting the arts and various youth-music projects, and since 1999 has provided a 16-track recording studio where 13 to 20-year-olds are able to record and remix their own music. The six participants involved in the study were all attending the Girls' Brigade band at the centre, which met once a week in the evening. Two leaders (one male, one female) regularly ran the workshops, which were aimed at developing participants' skills as popular musicians by providing a space for regular rehearsal, recording and preparation for gigs. The sessions recorded for the current study were captured over a two-week period.

As in the previous study in a community centre, the researcher set up the eJay software in a separate room from the main Girls' Brigade band activities. During the Girls' Brigade band sessions, participant would come into this room. There they were presented with Rave, Dance and Hip hop eJay CD-ROMs and asked by the researcher to choose which one they would like to use. The average task time in the Girls' Brigade band setting was 25.10 minutes.

12.3.1.2 Music camp setting

The summer music camp was one that was held once a year in Milton Keynes, UK. The camp has been running for over 30 years in the grounds of a well-known music venue and specialises in providing a friendly and supportive space where talented young people with various levels of classical instrumental training can meet and enjoy a week of making music and having fun. The camp was timetabled, with sessions being run by various leaders specialising in different instruments, styles and performance techniques. All sessions were geared towards a concert performance for parents, organisers and leaders at the end of the week.

Ten participants were involved in the present study and all were attending the music camp. The study was conducted in one of the dressing rooms of the music venue, where the software was set up in a same way as in the community-centre setting (PC with external speakers). Participants would come to the room to take part in the study, where they were presented with a choice of three eJay styles (Dance, Rave, Hip hop) to work on. The average task time in the music camp setting was 28.11 minutes.

12.3.2 Participants

Before the sessions were carried out, letters outlining the study and when it was taking place were sent to Girls' Brigade band and music camp organisers and leaders (see Appendix 8).

As the researcher was not allowed access to individual participants' addresses, the leaders from both settings forwarded a letter outlining the study to participants' parents. Participants were selected, based on those who volunteered and whose parents had consented for them to be involved. Participants were also able to change their mind about being involved in the study and withdraw at any point should they want to. This was explained in the letter sent to parents and to each participant prior to the study.

From the Girls' Brigade band setting, three dyads (six female participants, mean age 14.8 years) were involved. From the Music camp setting, five dyads (seven female and three male, mean age 14 years) were involved. In both settings the dyads knew each other, being either friends or acquaintances, with one dyad in the music camp setting being sisters (Dyad 4).

12.3.2.1 Participant questionnaire

To assist with the research aims, prior to each session the researcher asked each participant the following questions:

1. Do you play a musical instrument; if so which instruments do you play?
2. How were you taught to play your instrument?
3. Where do you receive your tuition (at school, at home or with family and friends)?

As demonstrated in Table 12:1 in the Girls' Brigade band group, three played instruments but only one reported having any formal instrumental training (see Dyad 3), who was studying for Grade 5 violin. In this respect Dyad 3 could be considered as 'bi-musical' (McCarty, 1999) in that they were learning music through formal and non-formal approaches. In addition, the Girls' Brigade band coordinator also mentioned that the girls in Dyad 3 were from families that were actively involved in music; both their fathers were in bands and one of the participant's learnt to play the drum from her father. In this respect this dyad was very much embedded within a non-formal music-making scene. It is interesting to note that Dyad 2 from the Girls' Brigade band sessions were the most recent members to join the group. When speaking with them they said they were singers. Interestingly though, they did not consider their voice as an instrument, while the musical Dyad 3 participants and the formally trained musicians in the music camp setting did, listing voice as one of their main instruments.

All of the music camp musicians had received formal instrumental training, with some being trained and taking exams on more than one instrument. One of the participants in Dyad 5 was the only music camp participant not taking music exams. This participant was from the USA and explained that the musical education system he was working within did not currently require him to take exams.

Table 12:1: Girls' Brigade band and music camp: Overview of participants' prior musical experiences

Setting	Dyad	Instrument	Grade	Mean age	Time on task
Girls' Brigade band	1	Recorder	No	15	18.23
		Missing	Missing		
	2	None	No	14.5	26.43
		None	No		
	3	Violin	5	15	30.24
		Guitar			
		Voice	No		
		Drums			
		Bodhrain			
		Guitar			
Music camp	4	Flute	4	13	24
		Cello Keyboards			
		Recorder			

	Violin			
	Viola			
	Piano			
	Descant			
	Treble & tenor			
	recorder	4		
5	Piano	No	14	37.47
	Violin			
	Flute	5		
	Piano	6		
6	Clarinet	5	14.5	26.49
	Piano	5		
	Drums			
	Violin			
	Piano	6		
	Flute	4		
7	Voice	8	14.5	32.39
	Piano	5		
	Missing			
	instrument	7		
	Trombone	5		
8	Recorder	8	14	19.24
	Piano			
	Violin	5		

12.3.3 Task

The rationale for using eJay software was provided earlier (Chapter 10, Section 10.3.2) when the first study using this software was introduced. In both settings examined in this chapter, the researcher welcomed and introduced the participants to the session and presented them with the task. As in the previous study (Chapter 11), the task instructions were set by the researcher, which were 'to compose together a piece of music using the eJay samples as they wished' from participant choice of Rave, Dance or Hip hop eJay.

When the participants were clear about what they had to do, the researcher then gave a short demonstration (see Appendix 9) to each group on how to click, play, listen, drag and place samples on the arrange page, as well as how to rewind, fast-forward and play their compositions. As in the previous chapter, the demonstration period acted as a short informal training session. During the demonstration, participants were encouraged to ask questions so as to ensure that they all understood how to use the software. The researcher also stayed with the participants during the session to ensure they had no problems. As before, the aim was to capture the session as naturalistically as possible with minimal interference from the researcher.

12.3.4 Procedure and analysis of the verbal dialogues

As in the previous eJay studies, during each session participants' interactions were recorded on video. The same video camera set-up as outlined in the previous studies was used. The researcher also took observational notes during the session.

The coding scheme, developed for the thesis, was also applied to the data from these non-formal settings. Again, the same software (MEPA and SPSS) used for entering and analysing the data. For a detailed account of the development and rationale of the coding scheme and the software used the reader should refer back to Chapter 8 and to Appendix 7 for the short version of the coding scheme.

12.4 Results

12.4.1 Quantitative analysis – descriptive statistics

Figure 12:1 represents the percentage proportion of each category of talk spoken across all the dyads in the Girls' Brigade band setting. Figure 12:2 represents the proportion of each category of talk across all the dyads in the music camp setting. The results indicated that in the Girls' Brigade band setting (n= 3 dyads), musical suggestions (S1), musical extensions (E1a), questions (Q), and agreements (SUP1) were the most frequently occurring categories of talk. In the music camp (n=5 dyads) setting the most frequently occurring categories of talk were also musical suggestions (S1), musical extensions (E1a), questions (Q), and agreements (SUP1). As in the previous studies, to find if these codes were significant the average for each code within each of the two settings was calculated and subtracted from the mean (5.55). Within the Girls' Brigade band setting the categories that fell at or above the SD value of 6.5 (see Figure 12:3) were considered the most significantly frequent type of talk, which were musical suggestions (S1), musical extensions (E1a) and positive support/agreements (SUP1). Within the music camp setting, the categories of talk that fell above the SD value of 6.02 (see Figure 12.4) and which were statistically the most significant for this setting, were musical suggestions (S1), musical extensions (E1a), questions (Q), and agreements (SUP1).

These findings suggest that even when the participants have different prior musical experiences and levels of training they engaged in very similar ways of talking with one another. The conclusion is that the way in which the setting was organised and the mediating influence of eJay were so powerful that they overrode the differences in participants' prior musical experiences. However, further in-depth analysis of the quality of the participants' talk demonstrated that there were more subtle differences between the groups, which the coding scheme failed to pick up. These points are addressed in the following sections.

Figure 12:1 eJay *Girls' Brigade band - percentage of each category of talk*

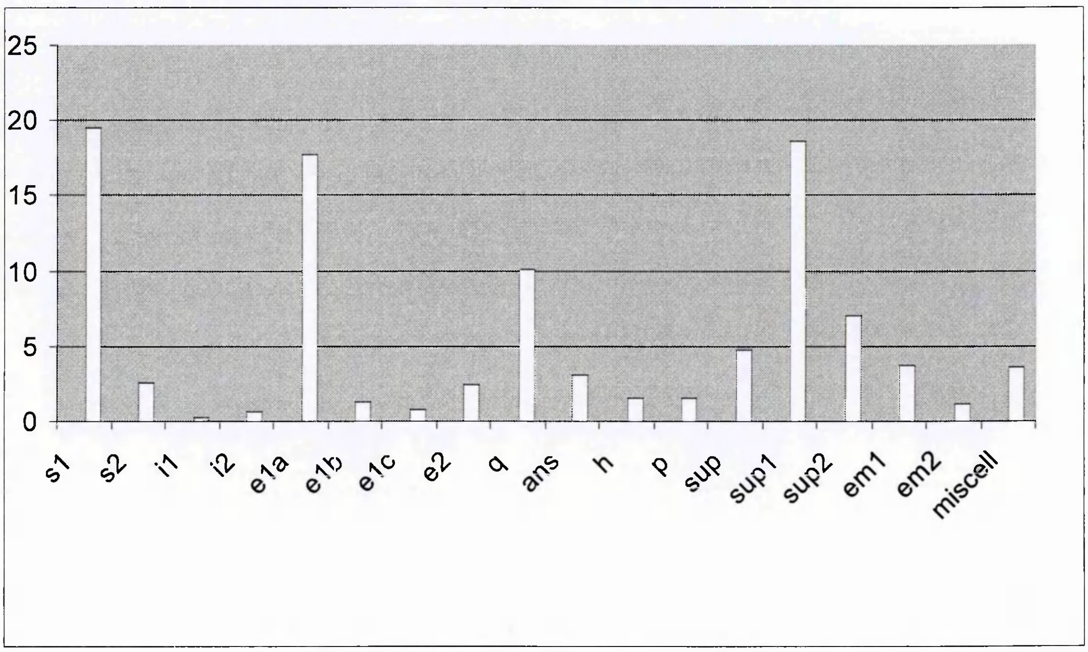


Figure 12:2 eJay *music camp - percentage of each category of talk*

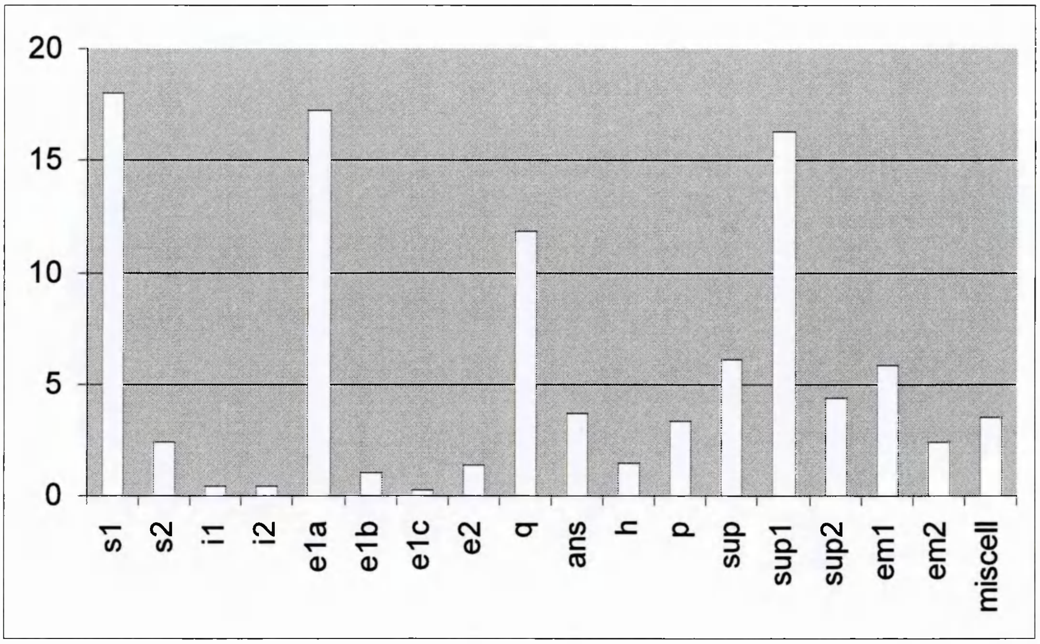


Figure 12:3: eJay *Girls' Brigade band*

Most frequently occurring categories of talk (mean, 5.55; SD = 6.5; n=3 dyads)

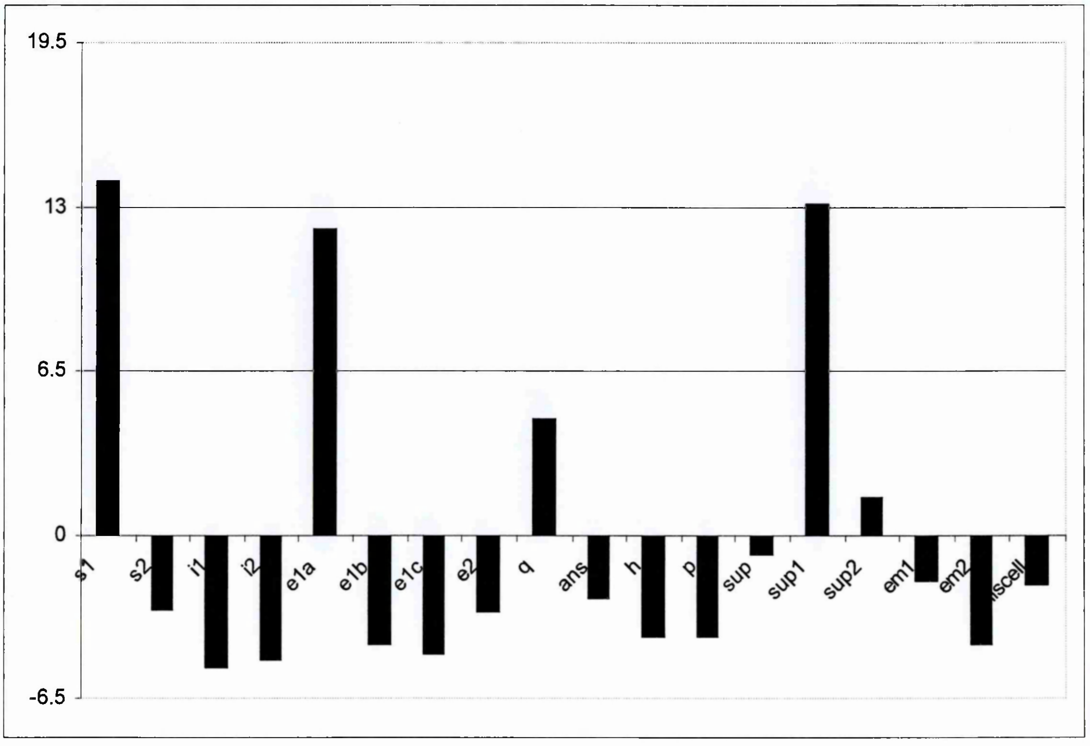
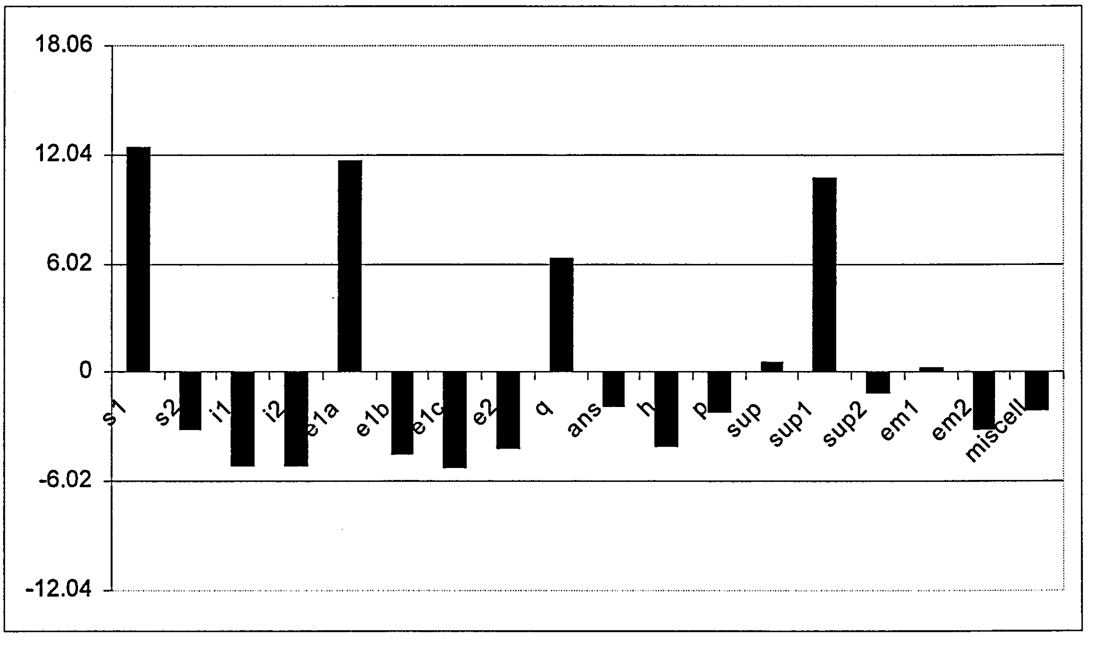


Figure 12:4: eJay *music camp*

Most frequently occurring categories of talk (mean, 5.55; SD = 6.02; n=5 dyads)



12.4.2 Qualitative and interpretative analysis

As in the previous studies, the aim of interpretative analysis was to focus in more detail on the social and temporal nature of the participants' interactions. In this study the main concern was to explore how the participant prior musical experiences were invoked within their dialogues and whether further evidence could be found of the ways in which the participants' musical background influenced their compositional processes.

12.4.2.1 The influence of prior musical experience

As found in the previous eJay studies reported in this thesis, the now identifiable cyclical processes of exploration, problem discovery and definition, editing and refining were also found in this eJay study. Again, although it was positive to find that eJay supported varying abilities, there were some qualitative differences found in the way those with prior bi-musical and formal instrumental tuition discussed their compositions in comparison with those who had no such experiences. One of the noticeable findings from the interpretative analysis was the similarity between Dyad 3 from the Girls' Brigade band and the music camp dyads compositional processes. More than the other Girls' Brigade band pairs, Dyad 3 appeared to have clear ideas about what they wanted to achieve. This is not to say that they listened to fewer samples or explored the sound of the software and its functions any less, but rather that they developed a feel for what they wanted to achieve more quickly. This was most noticeable in the sequences of dialogues in which they searched for samples that would fit into their ideas for their composition. For example, as demonstrated in Sequence 12:1, participants were very clear that they need a 'punchier' sound (Line 36). They also tended to be more critical of the eJay sounds; for example, see Line 46, where the participants refer to the 'simple' sounds of eJay.

Sequence 12:1: eJay *Girls' Brigade band, Dyad 3: Compositional Process*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
34	1	C	S1	We need to come back into a better, um, after the snare we need to come into a different kind of beat
35	1	R	SUP1	Yeah I know
36	1	C	E1b	Punchier
37	1	R	E1a	Now it comes,
38	2	R	S1	The melody really needs to start here
39	1	C	SUP1	Yeah, so

40	1	R	S1	Let's go back to the drums (t.t.)
41	1	C	SUP1	Let's go back to the drums (t.t.), yeah
42	1	R	SUP	Um
43	1	C	S1	If you go down
44	1	R	SUP1	Ah yeah
45	2	R	X	Xxx
46	3	R	E1a	This is all kind of simple things (i.e. the samples are simple, clicking and playing some samples)
47	1	C	E1b	Not very punchy is it
48	1	R	S1	Ah high-hat (referring to the high-hat sounds)
49	2	R	E1a	Could we have that one underneath there, starting there
50	1	C	SUP1	Yeah maybe, yeah try
51	1	R	Q	Which one is it, um, that wasn't it
52	2	R	SUP	Um (trying some more high-hats)
53	1	C	EM1	That's quite nice
54	1	R	Q	Can we do that?
55	1	C	SUP1	Yeah, that do that one
56	1	R	Q	Um, under here?
57	1	C	A	Um, under there
58	1	R	S1	Crash (going into green)
59	1	C	E1a	Might come in (referring to crash symbol sounds)
60	1	R	E1a	Not yet, later
61	1	C	SUP1	Yeah, not yet, later

Notes: t.t. = talk together; s.n = sample name; s.t = sample type

It appeared that the musical Dyad 3 in the Girls' Brigade band setting and the music camp musicians relied less on the samples as their main source of inspiration and seemed to have clear 'eureka' moments, such as Sequence 12: (Line 12) 'I know, I know, I know', and ideas about how to create the sound they wanted. For example, see Sequence 12: and Sequence 12:2 where the participants, very early in their compositional processes (as indicated by the line number), developed clear ideas about how to arrange the work. In this respect they appeared to have some idea of what they wanted to achieve before engaging in lengthy 'try and see' exploratory phases. Instead, they went searching for the appropriate samples that fitted around preconceived musical ideas.

Sequence 12:3: eJay *music camp, Dyad 4: Compositional Processes*

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
5	1	C	S1	Shall we just put some on and mix them around or something, or
6	1	L	S1	Yeah, put one of those outta space ones
7	1	C	Q	What?
8	1	L	E1a	Outta space, outta space, 1,2,3 (pointing)
9	1	C	Q	1, 2, or 3?
10	1	L	A	2 ...
11	2	L	S2	Drag (drags with mouse to arrange page)
12	1	C	S1	I know, I know, I know (in relation to the above, she knows how to drag the mouse)

13	2	C	E1a	Right and do you want a bass underneath (going into samples)
14	1	L	SUP1	Em, yeah
15	1	C	Q	What do you want? (scrolling through bass)
16	1	L	S1	What about xxx (both laugh), yeah, (laughs) put it on a wee bit after the sequence ones, yeah
17	1	C	Q	About there?
18	1	L	SUP	Ahem
19	1	C	Q	And then what do you want, do you want?
20	1	L	S1	A bit of voice then
21	1	C	S1	Do you want a sort of bit of drum going all the way across or something
22	1	L	SUP1	You could have a wee bit of something going on for a while

Notes: t.t = talk together; s.n = sample name; s.t = sample type

Sequence 12:2: eJay *Music camp, Dyad 7: Compositional Processes*

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
38	1	D	S1	We need a loop in there (M goes into loops)
39	1	M	SUP1	Yeah (going into loop)
40	1	D	SUP2	No (referring to sample)
41	1	M	SUP2	No (referring to sample)
42	2	M	SUP1	Maybe (going into loop)
43	1	D	SUP1	Yeah, put that in (head bobbing)

44	1	M	E1a	Yeah and put something
45	1	D	E1a	With that put something on top of it
46	1	M	SUP1	I' m just ... (placing sample on arrange page)
47	1	D	E1a	You just putting random ones in aren't you
48	1	M	E1a	Well it's the same thing, just different versions of it, rather than (places them up on arrange page and listen to it, M head bob)
49	2	M	SUP	Mmm ...
50	3	M	E1a	No, well, I mean, no, it doesn't quite work (stopping composition)
51	1	D	SUP2	No
52	1	M	E1a	Also, this first one sounds good
53	2	M	EM1	I really like it
54	3	M	Q	Shall we try moving that to ...?
55	1	D	SUP1	Yeah
56	1	M	Q	There?
57	1	D	S1	Put something else in its ... get rid of those (pointing)

12.4.2.2 Ending the composition

One feature that seemed to come across particularly in the music camp setting was an emphasis on deciding how the composition should end. This process was believed to be an influence of the participants' formal instrumental tuition, as classical music was one of the main styles of music these participants were enculturated within. Within this genre some of the most common ways in which to end a piece of music are by creating a climax, such as ending with loud drums or a big symbol crash, or alternatively by gradually fading out to silence. Within the Girls' Brigade band setting, the only dyad to discuss how their piece should end explicitly was Dyad 3, again demonstrating how similar this pairs' compositional process was to that of the music camp dyads. The following Sequence 12:3-Sequence 12:7) best demonstrate how participants' approached ending their compositions.

Sequence 12:3: eJay *Girls' Brigade band, dyad 3: ending the composition*

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
599	1	C	S1	And do you want a crash, one big crash at the end
600	1	R	E1a	Crashhh, yeah or the, the dun-dun-dun-na, the snare
601	2	R	SUP	Or dun-dun-dun-na-tshhhn (t.t.)
602	1	C	SUP	Tshhh (t.t.)
603	2	C	SUP1	Yeah ... and em

Sequence 12:4: eJay *music camp: dyad 5: ending the composition*

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
356	2	C	S1	Go on to effect, I reckon they would be on effect (L does)
357	3	C	S1	Oh why don't you just die away, sort of like, do a die away if we can actually do that, I don't know (i.e., die away refs to fade out)
358	1	L	SUP	Mmm
359	2	L	E1a	Don't know if you can actually do

				that (clicks and tries)
360	3	L	E1a	Oh, I wish we had found them (ref to effect she has clicked on)
361	1	C	E1a	Trust you
362	2	C	E1a	Crash, here we go (pointing, L clicks and plays)
363	3	C	EM1	That could be quite a good end (L plays crash again)
364	1	L	SUP	Mmm
365	2	L	EM1	That's quite good (ref to sample)
366	1	C	E1a	Move it in a bit, to be on 31 (i.e. bar 31, direct L), yeah, that quite good, yeah, now go from the beginning (i.e. play it from the start) that's our end I reckon
367	1	L	S1	Do you not want to put on a wee something on underneath like

Sequence 12:5: eJay *Music camp, Dyad 6: Ending the composition*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
439	2	F	S1	Alright, ah, we need something continuing down to the end (t.t.)
440	1	S	E1a	Something else (t.t.)
441	1	F	E1a	As melody (clicks into layers, looking for an appropriate fading sound to end the composition)

Note: t.t. = talking together

Sequence 12:6: eJay *music camp, dyad 7: ending the composition*

No	Turn	Participant	Code	Transcribed discourse

217	1	M	S1	Ah, I am goin' try this one
218	1	D	SUP1	Yeah, OK
219	1	M	S1	It's the sort of one we can try and finish off (referring to the bass drum he is in)
220	1	D	S1	Put something over the top

Sequence 12:7: eJay *music camp, dyad 8: ending the composition*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
44	1	S	S1	Crash (suggesting a s.n.)
45	1	D	SUP2	No, no
46	1	S	E1a	It would be better at the end, something crashie

Note: s.n. = sample name

12.4.2.3 Uses of specific music terminology

Other examples of the use of musical terms and knowledge were evident in the music camp setting. For example in Sequence 12:8, Participant F used the idea of 'transition' (Line 466) and of 'intro' (Line 470), while in Sequence 12:10 they talk about 'verse' (Line 97) and again about 'intro' (Line 107). In this respect, Dyad 5 used specific music terms to discuss the arrangement of the piece, clearly dividing the composition into 'intro', 'verse' and 'transition' sections. Similarly Dyad 7 from the music camp sample also talked about creating an 'intro' (Sequence 12:12, Line 7) and 'verse' (Sequence 12:10, Line 5) section, and about creating a 'pause' (Sequence 12:11, Line 301). This use of musical language demonstrated how the formally trained musicians tended to use more specific and specialised music terminology throughout their compositional process and in their negotiations with their partners to convey their ideas. In comparison, the Girls' Brigade band musicians, with the exception of Dyad 3, did not use such terms to talk about their work.

Sequence 12:8: eJay *music camp, dyad 5: use of music terminology*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
461	2	F	S1	Ah I want something going here
462	1	S	E1a	You want it slightly in the other one, so it's not just behind there (i.e. blend it in),
463	2	S	S2	Try that (meaning, listen from the beginning, with the sample S suggested added)
464	1	F	E1a	Ah, I don't know it needs, it smoother (referring to sample they added in, heads bob waving hand)
465	1	S	E1a	Just make it
466	1	F	E1a	As a transition
467	1	S	SUP1	Em, just, I don't know, you just have to
468	1	F	Q	You think we should just kick in with the drums right away too (stopping comp)
469	1	S	A	Yeah
470	1	F	E1a	Because we were just going to use this as an intro, but now that it is not intro it doesn't matter (S points)

Sequence 12:9: eJay *music camp, dyad 5: use of music terminology*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
97	1	F	S1	Let's call it the verse,
98	2	F	EM1	That pretty cool, I like that actually
99	1	S	SUP1	I do (F plays it again)
100	1	F	SUP2	I don't want any of that happy-hat (referring to sample name, trying more samples)
101	2	F	SUP1	Alright then
102	3	F	S1	Whirlpool (t.t.)
103	1	S	SUP1	Whirlpool (repeating)
104	1	F	S1	I think that should be some of the intro
105	1	S	E1a	Yeah, you don't actually need to happy-whirlpool, that one

Note: t.t. = talking together

Sequence 12:10: eJay *music camp, dyad 7: use of music terminology*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
3	1	M	S1	We say eh start, two, four bars in and have the snare fill leading up to that (t.t.)
4	1	D	X	xxx xxx, snare fill (t.t.)
5	1	M	E1a	So that's, one and a half, so the first verse
6	1	D	SUP1	Yeah that will do
7	1	M	E1a	Intro to the main thing

Note: t.t =talk together; xxx = unclear, not transcribed

Sequence 12:11: eJay *music camp, dyad 7: discussing the sound*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
301	1	M	S1	That would be great in the pause
302	1	D	SUP1	Yes, make it a pa ... (M goes to put the vocal sample)
303	2	D	E1a	No, no, coz the pause is there (pointing), so put it, put that, no put the snare fill there, put, yeah, put (to the manipulations that M is doing at the same time)
304	1	M	E1a	No, just get rid of this xxx, for one moment
305	1	D	SUP1	One wait, wait, just try it, OK

Note: xxx = unclear, not transcribed

12.4.2.4 Discussing the sounds and making associations

Although the Girls' Brigade band group did not use 'technical' music terms, they did make more associations between the music they were producing and the kinds of music practices and cultural activities they were interested in and involved with. For example, Girls' Brigade band Dyad 2 discussed the vocal and rap samples in eJay. This is interesting as these partners were singers and spent a lot of time searching though the rap and vocal samples, starting their composition with a rap vocal. Although they were not too impressed with either kind of sample, they spent much time playing and considering them, coming to the conclusion at one point that they 'could be famous' and create the whole track themselves (see Sequence 12:12, Line 108).

Sequence 12:12: eJay *Girls' Brigade band, Dyad 2, Cultural references*

No	Turn	Participant	Code	Transcribed discourse
101	2	1	SUP2	I don't want voice
102	1	2	E1b	No, it's kinda weird isn't it
103	1	1	E1b	It's really weird (both laugh)
104	1	2	S1	go down see what else they have got (pointing, i.e., scroll down more)
105	1	1	Q	What do they mean, do you know? (seems to be referring to the sample type and names)
106	1	2	A	I have no idea
107	1	1	SUP1	But
108	1	2	i1	We could be famous; we could be doing this all by ourselves (waving her hands, side to side)

Dyad 3, on the other hand, were quite specific about the kind of beats and rhythms that they wanted, as illustrated in Sequence 12:13; 'something quite simple' (Line 117) and 'basic' (Line 118) was what they needed and they avoided all vocal and rap samples. This preference may reflect their own instrumental backgrounds, in guitar and drums, which may have led them to favour more beat samples than vocal or rap samples.

*Sequence 12:13:*eJay *Girls' Brigade band, dyad 3: discussing the sound*

Line No.	**Turn**	**Participant**	**Code**	**Transcribed discourse and notes**
114	1	C	S1	Go on to xxx (says s.n. but not clear)
115	1	R	SUP	Ah
116	1	C	E1b	It's a little bit weak (as she clicks and listens to the sample)
117	1	R	E1a	Something quite simple
118	1	C	E1a	Yeah basic
119	1	R	E1a	Not the same way
120	1	C	SUP1	Yeah (clicks on more drums, still in green)
121	1	R	EM1	Yes, I like that (pointing)
122	1	C	EM1	Em, good xxx
123	1	R	Q	There? (i.e. place it here?)
124	1	C	SUP1	Yeah

Note: s.n = sample name; xxx = unclear word, not transcribed

Within the music camp setting, all five groups had differing opinions of what kind of sounds they wanted to create. Dyads 5 and 6 were quite specific, with Dyad 5, as previously discussed, dividing their composition in 'intro', 'verse' and 'transition' sections. When the task was finished, Participant S from Dyad 5 admitted that she did not like dance music, although she thought the session was OK and that the sample names were the best part of the program. Participant S would have preferred to use a program where you had more control rather than just clicking and dragging, and felt that with eJay you would probably always be producing a similar style of music. On the other hand, her partner, Participant F, thought it was 'great' and wanted it at home. He also made reference to a friend of his who 'spends hours' on a similar program.

Early in their session, the partners in Dyad 6 in the music camp setting told each other that they were not good at dance music: K said 'I am not, pretty, good at dance music actually you know', and S responded 'no, nor I'. This pair was more interested in trying to find 'metal' sounding samples, which reflected their interest in this kind of music as cited in the background information they provided about their musical interests. Participant K illustrated what she meant and the quality of sound she was after by trying to verbalise the sound, which appeared to confuse her partner but at least allowed her to get across some idea of what she meant (see Sequence 12:14, Lines 210-212).

Sequence 12:14: eJay *music camp, dyad 6: discussing the sound*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
210	2	K	S1	Ah, we need to go into something that's more boom-boom-boom-chushh-chushh-chushh (making sounds)
211	1	S	E1a	And then go into
212	1	K	E1a	Something like ding-do-ling or something, oh what was it loop, or something (looking in the dressing room mirror, making sounds and waving hands to demonstrate what she means)
213	1	S	Q	Has it got drum rolls and stuff, it mightn't have, will it?

214	1	K	Q	The loops what?
215	1	S	E1a	It'll just have silly little do-do-doh
216	2	S	E1a	Let's just try we have a tune, yet (K playing big loops)
217	1	K	EM1	That's quite cool (referring to the loop she played),
218	2	K	Q	What about that?
219	1	S	SUP	Mmm
220	1	K	E1a	Ah, I think that's what we got on there
221	1	S	S1	Shall we get rid of the euro bass, coz that really doesn't fit in
222	1	K	SUP1	Yeah (tries another sample, (K looks at the eJay CD cover)

Dyad 4 (two sisters) shared similar ideas and taste in sounds. The following extract illustrates how Dyad 4 communicated their ideas through singing what they wanted the composition to sound like (Sequence 12:15, Lines 93 - 94). In this way, participants D and S conveyed their ideas about the quality and feel of the composition, which in turn refined their sample selection and arrangement. This and the other sequences from the music camp setting demonstrated how the dyads had clear ideas about what they wanted and searched for samples to fit into this idea, rather than using the samples as a primary source of ideas and developing the composition from them. There was also some evidence that they were more confident to hum and sing their ideas as a means of demonstrating what they were trying to achieve to partners; whether this is reflection of their more advanced classical musical training is debatable.

Sequence 12:15: eJay *music camp, dyad 4: discussing the sounds*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
87	2	S	S1	And then you need like a tune on there (sort of pointing)
88	3	S	EM1	That's quite good (referring to a bass sound, S head-bobbing to it)
89	1	D	SUP1	OK
90	1	S	E1a	We could put that at the bottom xxx xxx (pointing, t.t., referring to arrangement of the sample)
91	1	D	E1a	OK, we could sort of put that there (emphasis)
92	1	S	SUP1	Yeah
93	1	D	E1a	Like, so it ... the last bit, so it's like do-do-do-doh
94	1	S	E1a	Well it could be there, and then it would be, del-del-del-lull and then when the crash comes in
95	1	D	E1a	Which one was it ... that one I think (i.e. what sample was it)
96	2	D	Q	What, like that?
97	1	S	A	Yeah
98	2	S	E1a	You have to play it to see if it works (taking on board S's idea)
99	1	D	E1a	Yeah, I should have started it from there, actually but never mind
100	1	S	Q	Why?
101	1	D	A	Coz you got all of that
102	1	S	SUP1	xxx yeah

103	1	D	EM1	That is nice (t.t.)
104	1	S	S2	Try (pointing) it (t.t., i.e. listen to it)

Note: xxx = unclear, not transcribed; t.t. = talk together

Another feature worth considering is the role played by cultural references within the dialogues. The category of talk that represents this kind of dialogue was cultural suggestions (i2), which represented references made to other music and cultural artefacts, such as films, television programmes, styles of music and so forth. There was also a category for the type of extensions (E1c) which were made to extend these forms of cultural references.

One of the most interesting sequences, which made use of such types of talk, occurred during a Girls' Brigade band interaction within Dyad 2. Sequence 12:18 demonstrates the partners' identification with particular styles of popular music and the motivation that this identification provided for these participants. Although this sequence of dialogue was the only one where cultural references were made in the current study, it is interesting that it occurred during an interaction between Girls' Brigade band partners rather than in the music camp setting. This is interesting because the sequence demonstrates how the participants identified and associated the music they were making with Ibiza-style dance music.

Sequence 12:16: eJay *music camp, dyad 2: cultural references*

Line No.	Turn	Participant	Code	Transcribed discourse and notes
447	2	1	E1c	This is more like Ibiza (referring to compositional style)
448	1	2	E1a	No, you could have it there, OK just,

				all you got to do is just move everything along
449	1	1	E1a	Yeah I know, but is it going to be good though
450	2	1	E1c	Coz this is more trancey, ain't it
451	1	2	SUP1	Yeah it's going to be alright (moving sample along to fit in new sample, so everything stays on the track)
452	2	2	SUP1	It'll be OK, they're all good
453	3	2	E1a	There to there (moving samples)
454	4	2	i2	I wonder if we have this at school
455	1	1	S1	What's the effect
456	2	1	EM1	This is better than them (referring to moving samples and adding new one)
457	1	2	SUP1	Yeah I know
458	1	1	EM1	I love all those,
459	2	1	i2	I'd love to have it in my house (referring to eJay program)
460	1	2	E1c	Yeah right, that would be alright
461	1	1	E1c	And then we could get our voices on to it (i.e. their own voices)
462	1	2	E1c	Ah, that would be, like get a beat going and hop, make a song of it
463	1	1	E1c	Can you get your voice on to it; you can, can't you, yeah, but not here
464	1	2	E1c	Oh yeah you can, yeah, have a proper studio but you couldn't do it here, they haven't got the right equipment

465	2	2	EM1	This ain't bad though; this is heavy (i.e. this is good)
466	1	1	E1c	It's really good isn't it, there is so many things you could do
467	1	2	E1c	I know, you could actually make a whole song
468	1	1	EM1	Yeah, this is good
469	2	1	E1c	But I wish we could have something like r'n'b,
470	1	2	SUP1	Yeah
471	1	1	S1	But there doesn't seem to be anything, we could try it, but we haven't looked at everything have we so (i.e. doesn't seem to be any r'n'b and we have not checked out all samples)
472	1	2	E1a	No (i.e. have not tried everything)
473	1	1	SUP1	Right

12.5 Discussion and conclusion

To recap, the research questions addressed in this study were:

1. What types of dialogue were used in non-formal (Girls' Brigade band and music camp) settings?
2. How did the participants' prior music-learning experiences influence their collaborative and creative processes?

From the above analysis of the Girls' Brigade band and music camp collaborations on eJay, the findings demonstrated that overall both groups engaged in similar types of talk. However, at the qualitative level there were differences and similarities in how the musicians called upon their previous musical experiences to inform and communicate how they made their music. However, based on the literature in this area (Folkestad, Hargreaves, & Lindström, 1998; Seddon & O'Neill, 2001a), one would have expected greater differences between the kinds of talk they engaged in. These researchers also examined the musical outputs of young people which is something not explored in the current study, and as a result it remains unclear whether one could have found difference between the music created by the music camp and Girls' Brigade band dyads. This aspect of the work needs developing, and it is intended the one of the ways of following up the work in this PhD would be to analyse the music created by these dyads.

At a qualitative level, however, the findings in some way support the observations and comments made by Seddon and O'Neill (2001a) and Folkestad (1998) that participants with formal instrumental training have a different approach to music making from those who do not. The main differences between the two settings were how all participants from the music camp engaged in discussions about how to end their composition.

In addition, many of the dyads from the music camp arranged their compositions into clearly identifiable sections; for example, introduction, verse and transition. Similar processes where found in Dyad 3 from the Girls' Brigade band. This dyad was considered bi-musical, in that they had a mix of formal and non-formal music learning experiences. It was also considered that the music camp participants were more able to express what kinds of arrangements they wanted to achieve, and instead of using the samples to lead the development of the structure they came to the session with what appeared to be a more explicit knowledge about how to arrange the composition. They used this knowledge to create their piece and search for appropriate samples (e.g. samples to fit into the intro and verse sections, and to use at the end). This supports the work done by Folkestad (1998), Seddon and O'Neill (Seddon & O'Neill; 2001a) and Scripp et al. (1983) indicating that participants with prior formal instrumental music training bring assumptions about preferred musical frameworks to the task, adhering more to the musical parameters associated with traditional notions of musical form and structure.

However, unlike in the other eJay studies examined in this thesis, there was no evidence that the participants with formal instrumental training explored the potential and range of the software any less than the Girls' Brigade band musicians. What appeared to be the case was that they were more selective and critical of the samples in eJay, which could be based on musical preference rather than musical training. But there was no evidence to suggest that they explored the sample any less. This finding may be explained in relation to the kind of music the eJay supports. Folkestad (1998) has suggested that exploratory behaviour may be related to the type of software and whether it is based on traditional and classical music or popular music. However further work would needed to be carried out in this area before any conclusions could be drawn; for example, it would be worth comparing the amount of exploratory talk engaged in in both Girls' Brigade band and music camp settings.

In relation to the research carried out on how popular musicians learn and the importance of liking and identification with the music (Cohen, 1991; Green, 1998; Rosenbrock, 2002), it was interesting that only in the Girls' Brigade band setting did identification with the music occur in the talk. Although this was evident within only one of the Girls' Brigade band dyads (Dyad 2), it did highlight the importance for this dyad in associating with the music and the motivation and empowerment that this brought. Despite r'n'b being the most preferred style of music for these participants, they were proud and delighted with the composition they created and during the session they spoke of doing more of this kind of work on their own, creating their own tracks and doing the vocals for these.

As noted, in the music camp setting, Participant S in Dyad 4, and both participant in Dyads 5 and 6 did not particularly associate with dance music or like it. Although they completed the task, if they had not been asked to compose using eJay, it is questionable as to whether they would have voluntarily chosen this style of music.

12.6 Summary and next steps

In sum, the study has shown that overall the types of talk engaged in within both settings were very similar (musical suggestions, musical extensions, agreement). The findings again highlighted that learning *organisation* rather than the learning *setting* played a greater role in understanding how meaning was created and the kinds of interactive patterns that emerged. In further exploring the organisation of the setting, the qualitative analysis provided insight into the more temporal aspects of the conversations that the participants engaged in. This analysis revealed more of the subtler differences and similarities between the groups' approach to composition. However, more work needs to be carried out in this area. It would be interesting to explore the Girls' Brigade band and music camp interactions using a range of musical technologies, technologies that are based on both traditional and popular music structures. It would also be interesting to conduct more in-depth interviews with musicians about how they perceive their own music practices and how this relates to their composition processes and the choices they make.

Finally, as Green (1998) has pointed out, there needs to be more research conducted on the practices involved in popular music making. Green and others (Cohen, 1991; Cope, 2001; Finnegan, 1989; McCarty, 1997, 1999; Rosenbrock, 2002) have focused very much on popular and rock musicians who play traditional instruments such as voice, guitar, drums, bass and so forth. It would also be of interest to investigate and interview musicians who successfully use new music technologies, such as professional DJs and electronic musicians to find out how they become enculturated into their music practices, learn their skills, and how this relates to their musical identity.

13. Final discussion, conclusions and recommendations

13.1 Introduction

Prior to beginning this thesis there was a general interest in understanding the creative collaborative processes people engage in when making music together using technologies. In investigating this, it became clear that no work had been carried out in this area, particularly in relation to young people's collaborations on existing school music technologies and in non-formal settings. Consequently this thesis is one of the first to bring together the areas of music technology, creative collaboration and research in formal and non-formal learning.

In summarising and reflecting on the work carried out, this final chapter returns to the main themes highlighted within the introduction and literature review chapters. The rationale and main research questions are reiterated and re-examined in relation to the main findings. The significance and contribution of this thesis to the areas of music education, collaborative creative and formal/non-formal learning are presented. Reflections on the research process, and on the strengths and weakness of the work are considered, within the context of recommendations for future research in this area.

13.2 Overview of theoretical position and key research questions

The research reported here examined the collaborative creative processes when making music together using keyboard and eJay sampling software in a variety of formal and non-formal settings. This work was situated in a review of existing literature, which outlined the need for understanding collaborative creative interactions around existing technologies in our current media-driven age. Theoretically the research drew on sociocultural and situated understandings of learning and development. This perspective emphasised the inextricable mutuality between the individual and their environs. This led to an understanding of the essential embeddedness of our actions and how the constitutional relations or features of a particular setting influence our behaviours, thinking and development (Cole & Griffin, 1987; Lave, 1979, 1988; Lave & Wegner, 1991; Rogoff, 1990; 1995).

The core tenets of sociocultural theory were outlined in the opening theoretical chapters (Chapters 2 and 3), where key terms such as mediation, intersubjectivity and appropriation were defined. The key thinkers in this area (e.g. Rogoff, Cole, Griffin, Vygotsky, Wertsch), provided the backdrop for a more informed understanding of how our environs and the contexts within which we operate influence our thinking and developmental processes. Drawing heavily on Rogoff's and Cole's work, the idea of foregrounding certain aspects of the context and setting, without losing sight of their inherent inseparability, informed much of the approach taken within this thesis. Such thinking helped to conceptualise how to best understand the different settings examined in this thesis as well as providing a language or lens through which to discuss the key findings.

Chapters 3 and 4 continued examining the thinking behind sociocultural understandings of mediation, focusing in particular on the role of dialogue and computers within collaborative learning. Chapter 3 in particular reviewed the outcomes of research on collaborative dialogues, which in turn shaped the dialogical, analytical approach taken in this thesis. Theoretically, the sociocultural roots presented in Chapters 3 and 4 were also complemented by perspectives from the field of situated learning (Lave, 1988; Lave & Wegner, 1991) and non-formal learning research (Eraut, 2000; Smith & Jeffs, 1990). Both areas emphasised the importance of understanding 'real-world', everyday learning, where problems are fuzzy, ill-defined and demand flexible, adaptive problem-solving strategies. Taking into consideration the digital worlds, which we now operate within, our everyday actions, indeed our lives, have become inextricably linked to communicating via technical devices. Understanding not only how we use these devices but also how they can be repurposed or redesigned for learning and creative expression was a key interest behind the work presented in this thesis. Chapter 4 presented some of the research on the role of computers within learning and creativity. What was continually clear from a learning perspective is that, to date, much of the research on how young people learn has been school-focused and does not adequately take into account the everyday and informal situations within which they also learn and develop.

Understanding the creative collaborative process added another layer of complexity to the overall areas explored within this thesis. Chapter 5, the last of the theoretical chapters, presented what literature was available in the area of creative collaboration using digital technologies and also provided an overview on how creativity and creative thinking was approached within this thesis. The key point made in this chapter was that creativity is not simply the outpouring of the individual genius in their ivory tower. Creativity is a complex, social construct, which emerges through a dialectical process among individuals of talent, domains of knowledge and various communities of practice. Despite many researchers understanding and accepting socially constructed perspectives on creativity, for most of them creativity is valued and rated in terms of tangible, novel, products and outcomes. Consequently, the creative process *per se* and its intrinsic value is neglected, not only on a societal level but also in learning contexts. Although more informed understandings of creativity have led to various policies and interventions to support creative thinking skills in school contexts, without a proper understanding of the creative process and it's value, they are in danger of failing.

Consequently, prior to embarking on this research, there was a general interest in examining the creative collaborative process, particularly in relation to music technologies. This interest stemmed from personal practice and experience, which over time merged with understandings from educational psychology. The outcome of this period of work, led to the development of three core questions, which have been addressed within this thesis, namely:

1. What kinds of verbal dialogues do young people engage in when working with keyboards and eJay software in formal and non-formal settings?
2. What are the collaborative creative processes young people engage in when making music together using keyboards and eJay software in formal and non-formal settings?
3. How do different aspects of the context (e.g. task setting and instructions; technology; prior musical and cultural experiences) influence the collaborative creative process?

To address these questions a dialogical method of analysis was adopted towards understanding creativity. The rationale for this approach was that through analysis of participants' verbal dialogues one could gain insights into the kinds of thinking participants were engaging in when making music together. Chapter 8 provided an overview of the dialogical coding scheme, which was developed for this thesis.

The following sections draw on the main findings from the empirical chapters, summarising and locating them within contemporary educational discourse in music education, creative collaboration and research on formal and non-formal learning.

13.3 Use of music technology across all settings

In examining the area of music technology, a survey was carried out of existing practices within secondary school classrooms (Chapter 7). The aim of the survey was to build on our understanding of how music technologies were applied in secondary schools, focusing on the kinds of music technologies that were used, the social context of use and teachers' personal accounts and impressions of using music technologies.

The most relevant findings indicated that keyboards and computers were the most frequently used technologies, while music technologies, in general, were used in group settings (most commonly in pairs).

Overall, teachers found that music technologies were most applicable at Key Stages 3 and 4 (11-16 years). Key problems teachers encountered when using music technology were: lack of confidence and expertise and technical support; breakdowns and networking problems; costs and keeping up to date. On a positive note, teachers found that music technologies motivated young people, in particular teenage boys, as they found it fun and enjoyable. Although it did require time to learn how to use the technologies, once they were mastered, pupils could use the equipment to create multilayered compositions, which could sound professional. Music technologies also allowed pupils to hear multiple parts at once, which enabled them to understand the different layers of the composition better and how the music was arranged. Other positive aspects of the technology were that it allowed those teachers who were familiar with equipment to plan a lesson easily and, in particular, it was useful for assessment as pupils could save multiple versions of a piece, which allowed teachers to track their progress.

What was of particular concern to the teachers was the lack of standardisation in teacher training. Variations ranged from teachers who were self-taught to others who had taken day courses, to some who had diploma or degree-level experience in using music technologies. As noted, this could lead to teachers only teaching with technologies they had training in, which, as noted in a recent Ofsted (2004) report, limits the potential of technologies to develop young people's skills and musical understandings.

Locating these findings in current debates, it's clear that exemplary practices tend to be driven by individual teachers who are passionately interested in this area. This is similar to the use of ICT in art (e.g. see Arts Council of England, 'Keys to imagination: ICT in art education', 2003), consequently such practices are unusual and sometimes little known outside the school or department context. It is believed that overemphasis on one or two pieces of hardware (e.g. keyboards) and software stifles teaching innovation. As noted in a recent Ofsted report:

> Most music departments base the majority of work in music technology on one piece of software – typically either sequencing or score-writing. This can result in pupils gaining limited experience in the wide-ranging applications of ICT in music. A minority of departments make good use of a range of software, including audio editing programs and CD-ROMs to develop skills such

as aural perception and understanding of musical form and history. (Ofsted, 2004, p. 4)

However, what was crucially flagged by the music survey carried out in this thesis was the need for a greater understanding of the kinds of musical interactions and processes that keyboards and computers supported. Despite music technologies being predominantly used in group settings, little is known about the kinds of processes engaged in when making music together in different contexts. This thesis specifically addressed this question, focusing on the kinds of activities typically carried out in schools and outside schools using these technologies. The thesis also extended this work into the area of non-formal learning, examining how young people composed music collaboratively using these technologies in non-formal community centre and music camp settings.

13.3.1 The mediating influence of technologies on the creative process

In exploring how different relations within a particular context influence the creative collaborative process, one of the key constitutional features explored within this thesis was the technology. As evident across all the eJay studies, the software's strong visual interface provided a distinctive support for partners' interactions, as they could 'see' their samples and compositions unfold. This was particularly evident in sequences of talk in which participants visually and verbally referred to specific aspects of the compositional structure. Additionally, the sample bank provided the young people with an instant wide range of sounds that they might otherwise not have had access to or would have spent a long time searching for or recording. Consequently, the software influenced the exploratory and discovery phases as some of the participants' ideas, particularly when using eJay, seemed to be inspired and driven by the software. In this respect, many of the eJay compositions had a similar quality (e.g. similar sound). For learning, it is important to emphasise to pupils that digital technologies, like other instruments, limit as well as opening up certain musical possibilities. In locating software such as eJay in the greater body of available instruments within the classroom, pupils can begin to see it, not as something separate from traditional musical instruments, but as part of a body of instruments they can use to achieve certain results. As Loveless (2002) notes:

> A characteristic of creativity with digital technologies would be the recognition of the potential of the features of ICT to be exploited and experimented with to support creative processes. Learners and teachers therefore need to have a range of experiences in which they can engage, play and become familiar with the distinctive contributions that ICT can make to their creative practices, which other media and tools do not offer. (Loveless, 2002, p. 12)

In addressing how digital technologies are being used creatively, Loveless categorises five key areas:

1. *Developing idea* – technologies been used to support imaginative conjecture, exploration and representation of ideas.
2. *Making connections* – supporting, challenging, informing and developing ideas by making connections with information, people, projects and resources.

3. *Creating and making* - engaging in making meanings through fashioning processes of capture, manipulation and transformation of media.
4. *Collaboration* – working with others in immediate and dynamic ways to collaborate on outcomes and construct shared knowledge.
5. *Communication and evaluation* – publishing and communicating outcomes for evaluation and critique from a range of audiences.

In relation to Loveless's categorisations, this thesis has demonstrated how music keyboards and eJay software can be used to develop ideas by identifying the kinds of creative processes young people engaged in and how in different settings they jointly constructed meaning and achieved shared goals.

Keyboards and eJay facilitated such interactions by providing a shared space around which participants could organise their creative, collaborative interactions. In the keyboard sessions, the facility to scroll through a variety of sound and sound effects and manipulate them provided participants with an immediate range of sound from which to build their compositions. Qualitative interpretation of the young people's dialogues suggested that the keyboard facilitated their music and collaborative practices by creating a space for partners to work and test out ideas, explore possibilities and experiment by playing different notes and samples. The pre-recorded sample and effects bank embedded within the keyboards was a source of inspiration in both task settings, while the save and record features allowed the participants to listen to and edit their work immediately.

Similarly, the range of samples stored within the eJay software provided instant source material, analogous to a painter's palette, from which participants could develop their compositional ideas. Other features of the interface, such as the 'click, drop and drag' approach to sample selection and arranging, afforded immediate modes of musical composition, while the graphic playback feature allowed the participants to listen to and reflect critically on what they had assembled.

In the eJay sessions it is believed that the graphic interface further enabled participants to discuss their ideas in more depth. A richer quality of talk was found in the eJay settings. Although when making music, verbal communication may not always be needed, when composing together, to maximise the potential for successful musical collaboration, pupils should be encouraged to develop critical, verbal skills.

Across the keyboard and eJay sessions it was evident that having equal access to the decision-making process when co-creating music was important. In the keyboard sessions, this was not always possible because of the division of labour adopted with the keyboard. In the eJay settings, the possibilities of shared decision-making increased as the graphic interface provided a visual map, which all partners could 'see' and contribute to. Such a resource was not present in the keyboard settings as the displays tended to be small and tucked on either side of the keyboard. However, the disadvantage in both settings was that keyboards and computers were not designed for collaborative use, they are individual instruments. Consequently, equal input from both partners is not always possible (e.g. there is only one mouse, only one person can turn the dial on the keyboard when scrolling though samples, and how you play the keyboard is different when working together). In such situations, turn-taking is important and teachers need to pay close attention to disruptive partnerships, where one partner is more domineering and takes much greater control of the keyboard or computer functions than another. In this respect, tasks around school keyboards and computers need to be constructed to support productive and constructive collaborations.

It is worth noting here that the school keyboard and eJay studies not only shed light on the creative collaborative interactions that occurred but also on how these technologies are currently positioned within the classroom. It is important to reiterate these findings and their implications for future research.

One problem observed when working on keyboards is the level of playing skills pupils attain. Practical playing skills ranged from one-finger/two-finger to one- and two-handed playing, with the majority unable to play with more than one hand at a time. Additionally, pupils' lack of technical knowledge about how the keyboard or computer works can mean that much of their time is spent on learning how to save or load previously saved material properly. In this respect, teachers need to ensure that pupils have a good grounding in the basics of how to operate these tools, and, in relation to keyboards, continue build, encourage and support pupils' playing skills.

In sum, prior to carrying out the research, little was known about the creative collaborative processes young people engaged in when working around keyboards and eJay. Additionally, there was a dearth of research on what contextual features influenced these processes, and there were questions around exactly what keyboards contributed to music education (Salaman, 1997). The findings outlined in this thesis demonstrated that both keyboards and eJay were central to supporting the cyclical creative processes of production, evaluation and redesign, as young people developed and explored sounds, discovered new ideas and defined their task. The research on the keyboard contributed to our understandings of how keyboards are used in schools (Appell, 1993; Chamberlin et al., 1993; Salaman, 1997) by specifically looking at what kinds of creative and collaborative processes keyboards support. The research on eJay demonstrated how the software provided an immediate, responsive, visual interface, which was found to be an important mediator (Barbieri & Light, 1992; Crook, 1994) in the kinds of creative collaborative interactions that unfolded within the different settings.

13.4 Creative collaboration – refining our understandings

This section focuses on the main findings informing the understandings of creative collaborative processes that emerged from this thesis. One of the key research questions addressed in this thesis was: What are the collaborative creative processes young people engage in when making music together using keyboards and eJay software in formal and non-formal settings?

Cutting across the core empirical chapters, the key findings provided insight into: 1) the cyclical nature of the collaborative creative process and characteristics of the different phases of the cycle; 2) the role of the technology in supporting the creative collaborative process (as discussed in Section 13.3); 3) the influence of contextual features (e.g. task instruction; prior musical experiences; cultural references) on the creative collaborative process.

13.4.1 The creative collaborative process – a dialogical perspective

Another of the three core research questions examined in this thesis was: What kinds of verbal dialogues do young people engage in when working around keyboards and eJay sampling software in formal and non-formal settings? In addressing this question a greater understanding of the nature of the collaborative process emerged.

This has several implications for our understanding of creativity and how we support and teach creativity. In particular, the findings contribute to our understanding of the differences between creative collaborative open-ended tasks and the research that has been carried out on how people work on well-defined tasks. Predominantly within collaborative research, there has been an overemphasis on well-defined tasks, where there is only one solution, such as in primary and secondary school maths and science subjects. Within these subject areas, teaching children to use exploratory talk (Mercer, 1996; Mercer & Wegerif, 1999; Mercer, Wegerif, & Dawes, 1999) has been found to be a useful intervention mechanism for supporting collaborative and joint problem solving. Due to the success and uptake of the concept of exploratory talk across the academic and teaching community (Dawes, Mercer, & Wegerif, 2000; Wegerif et al., 2004), government agencies, such as British Educational Technology Communication Agency[13] ('Becta'), have begun to advocate exploratory talk as 'the' way of achieving collaboration and joint problem solving (Becta, 2005). Unfortunately, this has led to a situation, which overemphasises exploratory talk as

[13] http://curriculum.becta.org.uk/docserver.php?docid=728

'the' way to achieve successful collaboration to the detriment of understanding whether it is always necessary or how in other task situations we achieve shared understandings.

Researchers (Kumpulainen & Mutanen, 1999, 2000; Van Boxtel, 2000) have shown that exploratory talk is not always present, and Mercer and colleagues have often reiterated that exploratory talk needs to be explicitly taught to children (Dawes, Mercer, & Wegerif, 2000; Mercer & Fisher, 1992; Mercer & Wegerif, 1999), and that when taught, it leads to significantly richer discussions and improved task understandings. However, the tests they run to prove this are based on well-defined, Raven Matrix tests, which show that if you teach children the rules for supporting logical problem solving, they will, when tested on well-defined problems, get good results. In sum, although Mercer and colleagues' work has been fundamental to our understandings of formal, school-based collaborations on certain types of well-defined tasks, such understandings do not translate to how we think when working on messy, open-ended or creative tasks. It could even be argued that exploratory talk actually 'gets in the way' of what Csikszentmihályi calls 'flow' (1997; 1990), which is an automatic, effortless, yet highly focused state of consciousness. If something is automatic and effortless then it should not be need to be supported by logical, rational forms of talk. However advocates of exploratory talk believe that this form of reasoning is most valuable in collaborative learning settings.

What this thesis has clearly indicated is that, in both formal and non-formal music technology tasks, exploratory types of talk were not engaged in and necessary to achieve shared understandings. The types of talk found were similar to what Mercer and Wegerif (1999) called 'cumulative' talk, which they usually dismiss as not leading to joint thinking. Cumulative talk consists of positive but uncritical decision-making talk, where suggestions are either accepted without discussion or with only superficial amendments. According to Mercer and colleagues, partners use cumulative talk to construct uncritically a set of 'common knowledge', and such periods of talk are characterised by repetitions, confirmations and elaborations. More recently, Wegerif (Loveless & Wegerif, 2004; Wegerif, 2004) has been investigating creative thinking and has begun to rethink the typologies of talk he and Mercer had previously advocated. Wegerif is now beginning to consider that cumulative talk may be more central to creative endeavours and that exploratory talk may not always be necessary for good quality collaborative learning.

However, to define collaborative creative thinking dialogues as uncritical talk is to undermine the complex decision-making processes that are at play during such phases of creativity. Collaborative creativity is more than a skill, which can be learned and performed on command; it is a sophisticated, cyclical and reciprocal form of interaction between learners and their environment. This was clearly highlighted in the research carried out in this thesis and was particularly evident in the kinds of interrelated and interdependent creative phases that the young people engaged in during the course of their activities. Across all the main empirical studies (Chapters 9 - 12) the collaborative creative process was explored in detail. Each study built on and complemented the understanding formed and together they led to the uncovering of a number of phases of creativity.

To summarise, the phases of creativity found in this thesis were:

1. *Exploration*: where participants explored the properties of the technology; randomly listening to sounds and without particular purpose searching for different sounds or playing pieces of music that they already knew (e.g. in the keyboard task).

2. *Discovery*: 'eureka' moments, which resulted from the exploration phase, where participants hit upon a sound or piece of music they liked, decided to keep it and used this to begin to build the composition. This could be a sound sample, a piece of music (e.g. usually something they already knew, a nursery rhyme, an appropriation of a religious tune, etc.), or a conceptual idea (e.g. 'we'll create a haunted house piece').
3. *Elaboration*: where discovered ideas are extended and built upon through complex interactive processes. The joint construction of meaning in the settings examined in this thesis was created through explicit and subtle verbal responses, which were augmented by the music and non-verbal communication.
4. *Critical listening*: when participants sat back, played through and listened critically to sections of the composition or the whole composition.
5. *Refining and Editing*: usually as the result of a period of critical listening, participants would edit and refine their composition. This period of editing and refining often led into further periods of exploration and discovery.
6. *Recording and Saving*: Often the final stage of composition, although intermittent phases of saving and recording occurred in both the keyboard and eJay settings. More often in the eJay sessions this usually happened as a result of the session ending. In the keyboard sessions participants often recorded various versions of their work.

It is important to note that the collaborative creative process is not a linear process, it is a continually cyclic, almost spiral-like process where each of the above phases feed back into one other and drive each other on. The collaborative creative process is, in-and-of-itself an open-ended process and is driven by ongoing divergent and convergent understandings, which are reached through talk as well as through collective listening. In sum, what was clear from the findings of this research was that collaborative creativity is sophisticated process. This process is driven by the continual interplay between individual and group consensus, understandings and interpretations of multimodal communicative processes. These multimodal processes included the music, verbal dialogue and the current 'vibe' or 'feeling' of the sound. In this respect, intersubjectivity and therefore shared understanding was achieved through the weaving together of various modalities. In attempting to understand this sophisticated situation, the research focused on one form of discourse, the verbal dialogues. In doing so it was clear that explicit reasoning was not necessary in this situation, and during some stages of the creative process it could be detrimental.

13.5 Exploring the context and its influence – understanding the task setting

In exploring how the different constitutional features of a particular setting influenced the creative process, one key aspect examined in this thesis was the setting, defined originally in this thesis as formal and non-formal settings. There has been a considerable amount of educational research that has shown how different learning resources mediate and support different kinds of interactions (Bennett & Dunne, 1991; Carraher, Carraher, & Schliemann, 1985; Cole, 1992; Van Boxtel, 2000). Additionally, outside of formal school settings, it was acknowledged that young people interact with a growing range of multimedia-based technologies, which they use differently from when working in school settings (Facer & Furlong, 2001; Prensky, 2001). The research carried out in this thesis was interested in exploring whether differences in the task setting and activity would influence the kinds of verbal dialogues and creative processes engaged in by the young people. To explore on a case-by-case level within each setting, particular contextual features were brought to the fore and examined. The analysis revealed some very interesting results. First, despite the differences in settings (school lunchtime keyboard sessions; classroom based eJay sessions; Boys' and Girls' Brigade sessions; Girls' Brigade band and music summer camp sessions), analysis of participants' verbal dialogues showed that across all the settings the young people most frequently engaged in similar types of talk (see Table).

Table 13:1 Overview of the most frequently occurring types of talk in all settings

Setting	Technology	Task Instruction	Musical Suggestions (S1)	Musical Extensions (E1a)	Positive Support/ agreements (SUP1)	Questions (Q)
School lunchtime	Keyboard	Structured		*	*	*
School lunchtime	Keyboard	Non-structured	*	*	*	*
School music lesson	eJay	Semi-Structured	*	*	*	
Brigade	eJay	Non-structured	*	*	*	*
Girls' Brigade band	eJay	Non-structured	*	*	*	
Music camp	eJay	Non-structured	*	*	*	*

The frequency of these types of talk (musical suggestions (S1); musical extensions (E1a); positive support/agreements (SUP1); and questions

(Q)) is a positive sign and shows that the groups were attuned to each other's needs; mutually engaging with each other; co-constructing new musical ideas and building on each others ideas - all of which are important as part of achieving intersubjectivity and a shared sense of continued joint action (Brown, Collins, & Duguid, 1989; Feldman, 1990; Kumpulainen, 1996; Wells, 1987). What is more difficult to ascertain using this methodology was how particular contextual features of the setting were influencing the interactions. To answer this question a deeper, qualitative understanding of the temporal nature of the transactions was necessary. This was achieved by focusing on sequences of dialogue and the moment-to-moment changes that occurred during the interactions. In this way, some aspects of the context began to reveal their influence. For example, in the Girls' Brigade band and music camp settings there was evidence to suggest that the participants' formal musical training influenced how they developed their compositional approach, while across all settings there was subtle evidence of how wider cultural references such as television viewing and pop culture influenced the young people's compositional ideas.

The main contextual features, which influenced participants' dialogues, were found to be the hardware and software participants were using. In this respect, the keyboards and eJay were the guiding features, which mediated the kinds of discourses and creative processes engaged in by the young people. This was an important finding, particularly given that within music education little research had been carried out which explored the use of a piece of software such as eJay in different settings.

Despite this finding, in reflecting on the research settings it also became clear that perhaps these were not as 'different' as originally envisaged.

Taking the understandings that Sefton-Green (2003) has established, he sees formal and non-formal as lying on continua - explicitly dsitinguishing the *learning setting* from the *learning organisation*. For example, on the continuum between formal and informal *settings* is learning that occurs in formal (e.g. school) settings, semi-formal (e.g. museum) settings, and non-formal settings, such as families and friendship groups. In contrast, on the continuum between formally and non-formally *organised* learning lies, at one end, learning that occurs explicitly through, for example, formally organised lessons and, at the other end, implicit (or accidental) learning that can occur while playing a computer game. In this thesis, it could be argued that the Girls' Brigade band and music camp settings were semi-formal settings, organised in a formal-like way (i.e. same task; sessions held in the presence of the researcher and video recorded, etc). Reflecting again on the research carried out in this field both from an educational and music perspective, one is forced to reconsider the claims and implications of this work. However, when reflecting on previous research and the work presented in this thesis, it is important not to emphasise how one particular tool or setting can change the type of learning that occurs. Instead, it may be more productive to pay attention to how different tools are organised within a setting and their subsequent relations. What may actually be occurring is that one particular contextual feature or relation within a setting is overriding all others and this is what influences the types of learning we see emerging. As a result, the hardware, software or training styles become the main feature influencing the evolving interactions. In this respect, it would be interesting to pursue this work and examine the kinds of interaction patterns that would be found if the software is used by choice as part of a leisure activity, such as at home.

In sum, researchers need to distinguish between the learning organisation and the learning setting. In this research it would appear that the learning organisation did influence the types of talk that emerged and therefore there were more similarities in the types of talk than differences.

Consequently, the conclusion is that the way in which the contextual relations are organised can override the physical setting within which the learning occurs. This is an important finding and further extends our understanding of the complexity of context, and in particular open-ended, creative contexts. However, another factor which was not taken into account in this research, but also needs to be acknowledged, is how interpersonal relationship (i.e. whether it was a friendship pair) can influence the creative process. Additionally, future research in this area needs to explore further the relationship between formal and non-formal learning, how, for example, creative experiences and insights are transferred from one setting, and how the organisation and design of a setting can best support creative collaboration.

13.6 Reflections on the methodological process

Reflecting on the exploratory procedure used in this thesis, it is believed that the research would have benefited from a more multidimensional methodological approach, where the music created by the participants was also analysed. Unfortunately, with the given time frame and resources, it would not have been practical for one person to carry out such in-depth analysis on both the verbal and musical communications. Future extensions of this research would benefit from such a multidimensional approach where the verbal dialogues, non-verbal and musical communication are analysed.

Additionally, as is always the case with dialogical coding schemes, the findings and results are a product of the coding scheme. Consequently, one has to be careful. The benefit of the coding scheme was that it provided a guide through the complex layers of communication at play within the settings and provided a 'handle' on the situation. Drawing on Rogoff's analytical approach to exploring context, the concept of foregrounding certain aspects of the setting without losing sight of the others, allows one to view context on different planes or through different lenses. This ensures that the researcher maintains an understanding of the complexity and essential interdependence of all relations within a given context. In this way, the verbal coding scheme provided a structured analytical framework within which each setting could be approached separately, while simultaneously providing a more in-depth understanding of the creative process.

What the coding scheme clearly failed to highlight was the subtler, temporal changes within the dialogical interactions and how the context influenced the co-construction of meaning and joint meaning making. For this reason, a second level of qualitative analysis had to be undertaken, which departed from the coding scheme and instead focused on larger sequences of dialogue. In this way a more in-depth understanding of each setting was arrived at.

To take this research further, I am keen to reduce the complexity of the coding scheme, to develop a more multidimensional approach, and to carry out further work on the creative collaborative phases that have been identified. My hunch is that these creative collaborative phases are important and that a greater understanding of each phase – their quality and how the quality differs from group to group; the duration and relevance of each phase at different points during the process; and whether similar or different phases occur when working on different kinds of open-ended, creative tasks - is necessary and worthy of further exploration.

13.7 Conclusions

In sum, the challenge of supporting creative collaboration is partially a question about context. To support rich creative learning experiences it is necessary to cultivate settings where learners have the opportunities to explore, discover, elaborate, critique and refine their ideas. This requires designing appropriate resources and organising learning contexts which maximise and foster creative relationships rather than hinder or suppress them. From the research carried out in this thesis, it is clear that how the context is organised plays a significant role in enabling this to happen.

As discussed in the above sections, exploring the core research questions addressed in this thesis has contributed to our knowledge of the fields of music education, creative collaboration and research in formal and non-formal learning by:

1. Extending our knowledge of existing music technology practices within schools
2. Examining for the first time how keyboards and eJay support collaborative composition and what they offer to music education
3. Providing a comprehensive analysis of the creative collaborative process and the beginnings of a model for understanding creative collaboration
4. Extending our knowledge of the influence of formal music training when making music using technologies
5. Extending our knowledge and understanding of context.

These findings are relevant to current educational debates. As noted in the introduction to this thesis, since beginning this research creativity and the formal - non-formal school continuum have become 'hot' topics. Notions of 'anytime, anywhere' learning and the recent surge of new journals (e.g. *Thinking Skills and Creativity*), books and reports (Loveless, 2002; Miell & Littleton, 2004; NACCE, 1999) on creativity are part of a new wave of political and educational research and discourse. As the Department of Media Culture and Sport (DMCS) in 2001 proclaimed:

> The most successful economies and societies in the twenty-first century will be the creative ones. Creativity will make the difference – to businesses seeking a competitive edge, to societies looking for new ways to tackle issues and improve quality of life.(DCMS, 2001)

In sum, creativity is currently regarded as the engine of economic growth and consequently is high of the political agenda (Bentley, 1998; Holden, 2004; Leadbeater, 2004; Seltzer & Bentley, 1999). It is not surprising, then, that educational rhetoric and reports such as the NACCE one call for 'a much stronger emphasis on creative and cultural education' (NACCE, 1999). New Labour initiatives such as Creative Partnerships[14], the National Endowment for Science Technology and the Arts[15] (NESTA), and Futurelab[16] reflect national strategies for finding out more about how young people can become more creative and how they can be equipped to lead fulfilling lives in the twenty-first century.

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[14] http://www.creative-partnerships.com/

[15] http://www.nesta.org/

[16] http://www.nestafuturelab.org/

Added to this, new digital technologies such as mobile phones, wireless networks and hand-held computers are providing increasingly pervasive learning opportunities and so the walls of traditional learning institutions are crumbling. Consequently, schools and teaching practices need to change; and for change to happen, innovation and creativity, collaborative creativity between teachers, researchers, software and the creative industries is essential. New technologies will provide new learning opportunities and, although school-based learning will not disappear, we need to understand the nuances of new digital learning opportunities - how they are organised; what they afford and limit; how we should best design and resource them. To address these questions we need to understand the context and environments within which learning occurs. We need to better understand the continuum between formal and non-formal learning and how learning transfers and transcends contexts. We need to ensure that we design creative, motivating and engaging learning opportunities, within which our pupils and teachers are equipped and able to become adaptive learners and educators. The outcomes of thesis will, it is hoped, go some way towards addressing, critiquing and understanding these issues.

14. Appendices

14.1 Appendix 1: Literature Review: List of relevant journals

Psychology (Social and Development) Journals

American Psychologist

Child Development

Merrill Palmer Quarterly

British Journal of Developmental Psychology

New Directions in Child Development

Human Development

Journal for the Theory of Social Behaviour

British Journal of Psychology

Journal of Cross Cultural Psychology

International Journal of Psychology

European Journal of Social Psychology

Social Development

Child Development

Computers/Computers and Education Journals

Journal of Computer Assisted Learning

Computers and Education

Journal of Interactive Media and Education

Education Journals

Educational Researcher

Journal of Artificial Intelligence in Education

Educational Research

European Journal of Psychology and Education

Learning and Instruction

The Journal of the Learning Science

British Journal of Research in Science Teaching

Journal for Research in Science Education

British Journal of Educational Psychology

Journal of Classroom Interaction

Studies in Higher Education

International Journal of Lifelong Education

British Educational Research Journal

Journal of Distance Education

Higher Education

European Journal of Psychology of Education

Cambridge Journal of Education

International Journal of Science Education

Contemporary Educational Psychology

Music Journals

Music Educators Journal

British Journal of Music Education

Journal of Research in Music Education

Canadian Journal of Research in Music

EGTA, Guitar Journal

Creativity Journals

Journal of Creative Behaviour

Journal of Aesthetic Education

Communication Journals

Language and Communication

Discourse Processes

Language and Education

Written Communication

Others Journals

Harvard Business Review

14.2 Appendix 2: Survey of Secondary School Music Teachers' Music Technology Practices

Name		
Date		
Title		
School		
Age		
Gender	Male	Female

SECTION A: GENERAL INFORMATION

How long have you been teaching music?

How long have you been at your current school?

What year groups do you teach?

SECTION B: Use of Music Technology

Do you use music technology in teaching music and if so what type of music technologies?

Yes No

If yes what do you use?

At what stages do you find music technologies most useful and why?

Key Stage 3 Key Stage 4 Key Stage 5

Do the children that you teach use a computer in music lessons?

All the time Some of the Time None of the time

Do the children use a sequencer in music lessons?

All the time Some of the Time None of the time

Do the children use a keyboard in music lessons?

All the time Some of the Time None of the time

SECTION B: Use of Music Technology *continued*

Do the children use Cubase in music lessons?

All the time Some of the Time None of the time

Do the children use Sibelius in music lessons?

All the time Some of the Time None of the time

What other software and musical technologies do you/children use in the classroom?

SECTION C: Social Context of Music Technology in Music Lessons

If you use any music technology in music lessons:

Do children use music technology (please define) in groups?

All the time Some of the Time None of the time

If you use groups what size groups do you use?

Pairs Threes Fours Four +

Are these groups mixed gender groups?

All the time Some of the Time None of the time

Are these groups of mixed ability?

All the time   Some of the Time   None of the time

How are the groups formed?

Teacher choice	Student choice

If other please specify

SECTION D: The Effectiveness of Music Technology in Music lessons

How useful do you find music technology (please define) in teaching composition?

Very useful   Quite useful   Somewhat useful   Not at all useful

How useful do you find music technology (please define) in teaching scoring and notation?

Very useful   Quite useful   Somewhat useful   Not at all useful

How useful do you find music technology (please define) in teaching general music understanding and knowledge.

Very useful   Quite useful   Somewhat useful   Not at all useful

How useful do you find music technology (please define) for teaching performance?

Very useful Quite useful Somewhat useful Not at all useful

How useful do you find music technology (please define) for instrumental learning.

Very useful Quite useful Somewhat useful Not at all useful

SECTION E: Children's Reactions to Music Technology

Do children enjoy using music technology (please define)?

Do children dislike using music technology (please define)?

How do you find the children respond to music technology (please define) in the classroom?

What are the disadvantages of music technology (please define) in teaching music?

Have you had any training with music technologies (please define)?

Yes No

If yes, what type of training have you had?

Thank you for participating in this survey any further comments would be appreciated.

FURTHER COMMENTS:

14.3 Appendix 3: Survey Invitation letter to Teachers

The Open University
Walton Hall
Milton Keynes
MK7 6AA

Dear Sir/Madam,

I would like to invite you to participate in a national survey of music teachers' experiences of using music technology. Music technology is defined as any digitally enhanced equipment that you may use in your music lessons. In particular we are interested in the types of technology you use and how your use it, the context of use, whether your think it is good and bad and what issues you find with it.

This research is part of an ongoing project conducted at the Open University, which is examining young people's collaborative social and musical interactions when using music technologies. Specifically for this part of the research we are interested in the teachers' perspectives.

Please find enclosed the five part survey – each section in clearly labelled and for each part we would like you to circle the correct response or provide some details about your experiences. The questionnaire should not take more than 20 minutes to fill out and all data collected will be used only for research purposes and is protected under the Data Protection Act 1998.

Once you have filled out the questionnaire, please return it in the stamped addressed envelope provided. If I do not hear back from you within the next two months, I shall give your school a phone call to remind you about the survey. Please remember your opinions are very much appreciated and your insights would importantly contribute to an area we currently know very little about.

If you have any further queries, please do not hesitate to contact me directly on the number below.

Yours Sincerely

Teresa Dillon

Teresa Dillon

The Open University, Department of Psychology

Walton Hall, MK7 6AA; m.t.dillon@open.ac.uk; 01908 695235 (work)

14.4 Appendix 4: Rules of Coding

An utterance is as a meaningful unit of speech defined in terms of the source, purpose and situated conversational meaning. This is best achieved by viewing the videotapes and becoming sensitised to the context and its nuances.

The boundaries between each utterance are based on semantic boundaries as noted by the coder.

All utterances receive one code.

First utterances, that is, the first introduction of musical (S1), technical (S2), descriptive (i1) and analogical (i2) codes refers to the new suggestions and ideas that have not previously entered the dialogues.

Support utterances are types of talk which positively and negative support the on-going communication.

Questions utterances are statements, which are calls for clarification and/or challenge partners' ideas. Question utterances are generally followed by answer utterances, which received a code (A). However in some case questions can be answered with a more extensive or detailed explanations in such cases these utterances receive an extensions code, depending on what the question was referring too. For example it should be a musical extensions (ext1a) or technical extensions (e2).

Talk that is spoken at the same time by both participant is denoted by (t.t) this refers to talk together. Most of the time when participant talk together they are excited and maybe saying different things, in that case each utterance would get a code depending on the meaning of the utterance. In some situations participant talk together but same the same thing, in this case both participant received the same code. As it attempts to illustrate that both participant had the same idea at the same time and spoke together.

When participant talk while listening to the compositions this is denoted by (t.l) that is talking when listening. In some cases the talk spoken at this time is difficult to transcribe as it is competing with the music that is being listened too.

Other abbreviations are:

s.n = sample name (i.e., the actual name of the sample as it is labelled in the technologies sample band)

s.t = sample type (i.e., if it is a loop, bass or voice sample)

Ref = refers too

Prog = programme

14.5 Appendix 5: Task Sheet for Keyboard Study:

Structured Task

A	B	A	C	A	D	A

14.6 Appendix 6: Parental/Guardian Permission: Keyboard Study

The Open University
Walton Hall
Milton Keynes
MK7 6AA

Dear Parent,

From (*insert date*), your son or daughter will be invited to participate in research that is been conducted at (*name school*) in conjunction with the Open University. The research will be carried out during lunch time (between 12.00-13.00) at your school on (*insert date*).

This research is part of an ongoing project conducted at the Open University, which is examining young people's collaborative social and musical interactions when using music technologies.

Teresa Dillon (researcher) from the Open University will be attending the sessions. Pairs of boys and girls from our son/daughters class will be invited to compose some music on the keyboards from approximately 20 minutes. Each session will be video taped.

The purpose of video taping the sessions is to observe the musical and social interactions between the young people engage in (both verbal and musical) with each other. Video recoding of the music sessions is a standard method of collecting observational musical data. All recordings will be handled with up most professional care and sensitivity. The video will only be used for research purpose (i.e. in the analysis and occasionally for conference presentations to illustrate the work). If any parents, or young people do not want the videos to be seen by anyone other than the researcher this would not be a problem and wouldn't prevent your son/daughter taking part in the study. The young people would also be able to change their mind about being involved in the study and withdraw at any point should they want too.

If you have any objection to allowing your son or daughter to participating in this research, please notify your son/daughters teacher (*insert name*), who will in turn notify the research. Participation in this research is voluntary and all data gathered is protected under the Data Protection Act, 1998. If you do have any further queries please do not hesitate to contact me, Teresa Dillon at the address below.

Thanking you for your support

Yours Sincerely

Teresa Dillon

Teresa Dillon
The Open University, Department of Psychology
Walton Hall, MK7 6AA; m.t.dillon@open.ac.uk; 01908 695235 (work)

14.7 Appendix 7: Coding Scheme: Shorthand

Content Codes	
Code	***Description***
S1 Musical Suggestions	The first introduction of new musical ideas related to the selection, arrangement and editing of composition.
S2 Technological Suggestions	The first introduction of new ideas regarding functions and manipulation of the technology, such as, listening, playing, saving, recording or programming the sample and effects bank.
i1 Descriptive Suggestions	The first introduction of new ideas based on descriptions of the quality of sounds.
i2 Cultural Suggestions	The first introduction of new ideas based on wider cultural experiences – such as from, television, film, pop charts and so forth.
E1a Musical Extensions	Utterances that extended musical suggestions (S1) and built on the first introduction of new musical ideas.
E1b Descriptive Extensions	Utterances that extended descriptive suggestions (i1) and built on the first introduction of descriptions of the quality of sounds.
E1c Cultural Extensions	Utterances that extended cultural suggestions (I2) and built on the first introduction references made to wider cultural experiences.
E2 Technological Extensions	Utterances that extended technological suggestions (S2) and built on the first introduction of new ideas on technological functions

Q Questions	Utterances that began with question words and utterances that were questions phrases.
A Answers	Utterances that are direct answers to direct questions, (Q) and did not provide any further detailed information.

Affective Codes

Code	**Description**
H Humour	Non-verbal communication such as laughter and verbal utterances such as jokes
P Personal	Talk that was not related to the task, for example, about exams, personal lives
SUP Non-verbal support	Non-verbal support such as 'ums', 'ahs', and so forth. Also included when participants hum and sing.
SUP1 Agreement	Utterances that expressed participant's agreement.
SUP2 Disagreement	Utterances that expressed participant's disagreement.
EM1 Positive emotive support	Utterances that expressed participant positive emotive reactions.
EM2 Negative emotive	Utterances that expressed negative emotive reactions.

Miscellaneous

XXX and XXX XXX	Miscellaneous utterances, which were, not clear enough to transcribe. XXX referred to miscellaneous words,

Miscellaneous	XXX XXX referred to miscellaneous sentences.

14.8 Appendix 8: Parental/Guardian permission: eJay Studies

The Open University
Walton Hall
Milton Keynes
MK7 6AA

Dear Parent,

From (*insert date*), your son or daughter will be invited to participate in research that is been conducted at (*name school*) in conjunction with the Open University. The research will be carried out during (*insert time and date*) at *(insert place*).

This research is part of an ongoing project conducted that the Open University, which is examining young people's collaborative social and musical interactions when using music technologies.

Teresa Dillon (researcher) from the Open University will be attending the sessions. Pairs of boys and girls from our son/daughters class will be invited to compose some music on computers using software called eJay for approximately 20-25 minutes. eJay is a software programme that allows you to sample and mix tunes in a professional, yet user friendly and enjoyable way. Versions of eJay (Dance and Hip hop) are commonly used in schools and educational settings for teaching children and teenagers' compositional skills. Each session will be video taped.

The purpose of video taping the sessions is to observe the musical and social interactions between the young people engage in (both verbal and musical) with each other. Video recoding of the music sessions is a standard method of collecting observational musical data. All recordings will be handled with up most professional care and sensitivity. The video will only be used for research purpose (i.e. in the analysis and occasionally for conference presentations to illustrate the work). If any parents, or young people do not want the videos to be seen by anyone other than the researcher this would not be a problem and wouldn't prevent your son/daughter taking part in the study. The young people would also be able to change their mind about being involved in the study and withdraw at any point should they want too.

If you have any objection to allowing your son or daughter to participating in this research, please notify your son/daughters group leader (*insert name*), who will in turn notify the research. Participation in this research is voluntary and all data gathered is protected under the Data Protection Act, 1998. If you do have any further queries please do not hesitate to contact me, Teresa Dillon at the address below.

Thanking you for your support

Yours Sincerely

Teresa Dillon, The Open University, Department of Psychology

Walton Hall, MK7 6AA; m.t.dillon@open.ac.uk; 01908 695235 (work)

14.9 Appendix 9: Script for introducing and demonstrating eJay in non-formal settings (Brigade, Girls' Brigade band and Music Camp)

Hello. I'm Teresa Dillon. I am from The Open University and I'm carrying out a study on eJay. Have you all given in your consent forms, which your parents should have signed? Are you happy to take part in the study?

Have you seen or used eJay before?

Which eJay style would you like to use (participant select)?

This is the eJay interface you don't need to use the keyboard just to mouse to play eJay.
Each sample is colour coded. The colour refers to the sample type that is whether the sample is a bass, vocal or effect sample.
To play a sample you simply double click on it in the selection box. You can also drag it to the arrange page and play it.
To scroll through the sample you use the button on the right of your screen. When you've dragged a few sample on the arrange page you can drag them around and place them where you like. This allows you to build your composition.
Once you a few samples arrange how you like, you can use the play, stop, rewind and fast forward buttons to play back your piece. The numbers at the top refer to the where in the arrangement you are, if you click on 12 it will take you to bar 12.
The erase button allows you to take our samples.

To save your composition click on save. We'll not be using the import function.

I'd like you to spend the next 20 minutes or so building a piece. Do you mind if I videotape you while you are working together? Thanks.
Note: If using the Hip hop eJay show you to use the scratch effect.

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