



Byrne, J.A. (2025) *Pupils as silent composers: experiences of multimodal learning and computer-based composition in the music classroom*. PhD thesis, Bath Spa University.

ResearchSPAce

<https://researchspace.bathspa.ac.uk/>

Your access and use of this document is based on your acceptance of the ResearchSPAce Metadata and Data Policies, as well as applicable law:-

<https://researchspace.bathspa.ac.uk/policies.html>

Unless you accept the terms of these Policies in full, you do not have permission to download this document.

This cover sheet may not be removed from the document.

Please scroll down to view the document.

**PUPILS AS SILENT COMPOSERS: EXPERIENCES OF MULTIMODAL
LEARNING AND COMPUTER-BASED COMPOSITION IN THE MUSIC
CLASSROOM**

JULIE ANN BYRNE

A thesis submitted in partial fulfilment of the requirements for Bath Spa University
for the degree of Doctor of Philosophy

School of Education, Bath Spa University

May 2025

Statement of Authorship

'This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement. I have exercised reasonable care to ensure that my thesis is original, and does not to the best of my knowledge break any UK law or infringe any third party's copyright or other intellectual property right'.

Ethics statement

This study was approved by the Bath Spa University Ethics Panel on 13/07/2016. Should you have any concerns regarding ethical matters relating to this study, please contact the Research Support Office at Bath Spa University (researchsupportoffice@bathspa.ac.uk). All participants provided written informed consent prior to enrolment in the study, ongoing verbal consent throughout and for any associated datasets to be utilised as presented within this thesis.

Data Statement

The datasets that support the findings of this study are provided in full within the results section and appendices of this thesis. However, the video recordings and their associated datasets are not publicly accessible due to restrictions, such as safeguarding the privacy of research participants.

Abstract

The thesis explores the multimodality of silence by seeking the significance of non-verbal communication in two pupils' computer-based composition during music lessons in a UK state secondary school. My study takes a multimodal social semiotic perspective on 'silence', meaning the absence of the mode of speech, and recognises other modes of communication beyond language. The study is positioned at the intersection of the fields of multimodal communication and music education.

During computer-based music compositional lessons, and from the perspective of a researcher and secondary school music teacher, we may not hear the pupils' computer-generated sounds because they wear headphones. In addition, pupils' facial expressions, gazes and gestures can be obscured by computer screens and further complicated by the rear-view teachers may have of their pupils. These partial representations challenge researchers and teachers in accessing a multimodal social semiotic account of the pupil's work and understanding their non-verbal communication.

Gaining a deeper insight into pupils' social semiotic work requires apt research methods. The study uses video-based observations of two pupils continued compositional work, over four lessons, to generate and frame the data. Sixteen instances of non-verbal communication without speech were selected and analysed amidst many instances identified within the overall semiotic work of the pupils. Applying multimodal social semiotic theory, principles of recontextualization (Bezemer and Kress, 2016) and design for learning (Kress and Selander, 2012) provides the most apt approach for making sense of pupils' non-verbal ('silent') communication.

Isolating two pupils' semiotic work builds on multimodal research in which the analysis of instances of non-verbal communication enables the identification of the signs of learning in modes other than speech. The study found that pupils' semiotic work evidenced learning through the specific choices they made to support their design for learning and further provided visibility to the complexity and richness of the multimodality of silence.

Acknowledgements

First, I am wholeheartedly indebted to Dr Kendra McMahon for her unfailing support, patience, generosity of time and for staying the course as my Director of Studies. In the same light, I wish to show my sincere gratitude to Sophia Diamantopoulou (Associate Professor, UCL) who joined the supervisory team in 2020, for her enthusiasm and insights into the realms of all things multimodal.

A special acknowledgement and my sincere thanks go to Dr Mary Stakelum and Emeritus Professor Stephen Ward. I am deeply grateful to Mary and Steve for their unwavering belief in me, encouragement and support, and for challenging me to strive for better.

I am incredibly grateful to TechSmith who freely sent me an educational license of Camtasia to support the study. I am also similarly thankful to Bath Spa University as they kindly gifted an educational Camtasia License to the research school for my research. In the same spirit, I extend my appreciation and gratitude to the staff and participants for willingly volunteering and committing their time to the study. I hope the thesis justly portrays their honesty and openness and thank them for sharing their composition work and experiences.

I thank my incredibly supportive partner, Mike. I am eternally grateful for your generosity and patience in waiting for me to accomplish this milestone whilst keeping me sane, safe and smiling.

My final thanks are owed to my parents. When the challenge seemed too overwhelming, Mum offered academic wisdom, proofreading skills, and a shoulder to cry on. Dad thank you for your stern words of encouragement of asking, 'Haven't you finished yet?' and the response I gave – 'No Dad, I have not. I have only just begun.'

Contents

PUPILS AS SILENT COMPOSERS: EXPERIENCES OF MULTIMODAL LEARNING AND COMPUTER-BASED COMPOSITION IN THE MUSIC CLASSROOM	1
STATEMENT OF AUTHORSHIP	2
ETHICS STATEMENT	2
DATA STATEMENT	2
ABSTRACT	3
ACKNOWLEDGEMENTS	4
CONTENTS	5
LIST OF FIGURES	10
LIST OF TABLES	11
ABBREVIATIONS	11
1.0 CHAPTER ONE: INTRODUCTION TO THE THESIS	12
1.1 RATIONALE	13
1.2 AIMS AND RESEARCH QUESTIONS	16
1.3 OVERVIEW OF THE THESIS CHAPTERS	17
1.4 CHAPTER SUMMARY	18
2.0 CHAPTER TWO: REVIEW OF RESEARCH LITERATURE	19
2.1 INTRODUCTION	19
2.2 THE RESEARCH DOMAIN OF NON-VERBAL COMMUNICATION	19
2.2.1 Non-verbal Communication in Music Education	21
2.2.2 Non-verbal Communication in Multimodality	24
2.3 EXAMINING HOW SILENCE IS PORTRAYED (ACROSS THE LITERATURE)	25
2.3.1 Silence in Music Education	28
2.3.1.1 Silence as a part of the Compositional Process	28
2.3.1.2 Frequency of Compositional Activities and Time Analysis	30
2.3.1.3 Pupil Talk Diminishes over Time in Composition	32
2.3.2 Silence in Multimodal Research	33
2.3.3 Summary	36
2.4 CONCEPTUALISATIONS OF LEARNING TO COMPOSE IN THE CONTEXT OF SECONDARY SCHOOL MUSIC CLASSROOMS	36
2.4.1 Implications of Social Constructivism in Music Composition	39

2.4.2	The Intersection of Sociocultural Learning and Multimodality in Music Composition	40
2.4.3	Multimodal View of Learning	42
2.5	EXAMINING COMPUTER-BASED MUSIC COMPOSITION AT SECONDARY SCHOOL IN THE UK	43
2.5.1	Teacher's Pedagogical Choices	43
2.5.2	The Role of Software and Computer-based Technology in Composing	44
2.5.3	Research Evidencing Pupils' Approaches to Computer-based Music Composition	46
2.6	RELEVANT RESEARCH FROM A MULTIMODAL SOCIAL SEMIOTIC PERSPECTIVE	49
2.6.1	Summary	52
2.7	MUSIC RESEARCH THROUGH A MULTIMODAL INTERACTIONAL ANALYSIS LENS	52
2.7.1	Summary	56
2.8	EDUCATIONAL RESEARCH FROM A MULTIMODAL DISCOURSE ANALYSIS PERSPECTIVE	57
2.8.1	Multimodal Discourse Analysis in Music Education Research	58
2.8.2	Summary	59
2.9	MUSIC RESEARCH FROM A MULTIMODAL CONVERSATIONAL ANALYSIS PERSPECTIVE	59
2.9.1	Multimodal Conversational Analysis in Music Education	60
2.9.2	Summary	61
2.10	MUSIC EDUCATION RESEARCH THAT DRAWS ON MULTIMODALITY	61
2.10.1	Studies using Sociocultural Theory and Multimodality	62
2.10.2	Two Studies using a Multimodal and Ecological Approach	64
2.10.3	A Study using a Kinaesthetic and Multimodal Perspective	66
2.10.4	Summary	66
2.11	CHAPTER CONCLUSION	67
3.0	CHAPTER THREE: MULTIMODAL SOCIAL SEMIOTIC THEORETICAL FRAMEWORK	
3.1	INTRODUCTION	70
3.2	MULTIMODAL SOCIAL SEMIOTIC THEORY OF COMMUNICATION	70
3.3	MODES AND THE RESOURCES OF MODES	72

3.3.1	Preceding Modal Prompt	73
3.3.2	Transduction	74
3.3.3	Transformation of Resources	74
3.4	DESIGN AND DESIGN FOR LEARNING	75
3.4.1	Design	76
3.4.2	Design for Learning	77
3.5	PRINCIPLES OF RECONTEXTUALIZATION	79
3.6	CHAPTER SUMMARY	80
4.0	CHAPTER FOUR: METHODOLOGY	82
4.1	INTRODUCTION	82
4.2	RESEARCH DESIGN	82
4.3	RESEARCH CONTEXT - THE SCHOOL AND PUPILS	84
4.3.1	Selecting the School	84
4.3.2	Rationale for Focusing on Two Pupils	85
4.3.3	The Selection Process for Participants	86
4.3.4	The Role of the Music Teacher in the Research	87
4.4	METHODS FOR DATA COLLECTION	87
4.4.1	Camtasia	88
4.4.2	Video Captured with a Small Camera	90
4.4.3	Documentary Data	92
4.4.4	Observation and Field Notes	93
4.4.5	Researcher Journal	94
4.5	GENERATING AND FRAMING THE DATA	94
4.5.1	Stage One - Mapping a Lesson Overview using Camtasia Video	95
4.5.2	Stage Two - Mapping Instances of Non-Verbal Communication	100
4.5.3	Operationalisation of the Principles of Recontextualization	104
4.5.3.1	Framing	104
4.5.3.2	Selection	105
4.5.3.3	Arrangement	105
4.5.3.4	Foregrounding	106
4.5.4	Summary of Generating and Framing the Data	107
4.6	ANALYSIS AND MULTIMODAL TRANSCRIPTION	107
4.6.1	Determining the Length of Instances of Non-Verbal Communication	108

4.6.2	Principles of Transcription	110
4.7	TRUSTWORTHINESS	110
4.7.1	Building Rapport and Establishing Familiarisation with Research Equipment	111
4.8	RESEARCHER'S REFLEXIVITY	113
4.9	ETHICAL CONSIDERATIONS	115
4.9.1	Negotiating Access	115
4.9.2	Informed Consent	116
4.9.3	Ongoing Verbal Consent	117
4.9.4	Participant Anonymity	118
4.9.5	Keeping the School Anonymous	119
4.9.6	Project Approval	119
4.9.7	Data Protection	119
4.9.8	Debriefing Sessions	120
4.10	CHAPTER SUMMARY	120
5.0	CHAPTER FIVE: FINDINGS: ANALYSIS AND INTERPRETATIONS OF SIXTEEN INSTANCES OF NON-VERBAL COMMUNICATION	121
5.1	INTRODUCTION	121
5.1.1	Different Camera Angles on the Pupils' Seating Positions	123
5.1.2	The Computer-based Compositional Task	123
5.2	LESSON ONE - THE BEGINNING	124
5.2.1	Episode One	125
5.2.2	Episode Two	133
5.2.3	Episode Seven	145
5.2.4	Episode Eleven	153
5.2.5	Summary of Lesson One	161
5.3	LESSON TWO - THE HARMONIC FRAMEWORK AND LEITMOTIFS	163
5.3.1	Episode Six	164
5.3.2	Episode Nine	181
5.3.3	Episode Fifteen	201
5.3.4	Episode Thirty-three	215
5.3.5	Summary of Lesson Two	223
5.4	LESSON THREE – MATCHING THE ACTION	226
5.4.1	Episode Five	227

5.4.2	Episode Ten	240
5.4.3	Episode Eighteen	256
5.4.4	Episode Twenty-five	273
5.4.5	Summary of Lesson Three	284
5.5	LESSON FOUR – BRINGING IT TOGETHER AND REFLECTION	286
5.5.1	Episode Four	286
5.5.2	Episode Eleven	294
5.5.3	Episode Twenty-four	305
5.5.4	Episode Forty-two	329
5.5.5	Summary of Lesson Four	339
5.6	CHAPTER SUMMARY	340
6.0	CHAPTER SIX: DISCUSSION	345
6.1	INTRODUCTION	345
6.2	THE SIGNIFICANCE OF NON-VERBAL MODES IN COMPUTER-BASED MUSIC COMPOSITION	347
6.2.1	Signs of Engagement and Interest	348
6.2.2	Signs of Control and Agency	355
6.2.3	Signs of Negotiation	360
6.3	THE PUPILS’ SILENT SEMIOTIC WORK AS SIGNS AND DESIGNS FOR LEARNING	363
6.3.1	Transformation of Resources as Signs of Learning	364
6.3.2	The Pupils’ Design for Music Compositional Learning	370
6.4	CHAPTER SUMMARY	377
7.0	CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS	379
7.1	INTRODUCTION	379
7.2	SUMMARY OF THE THESIS	379
7.3	CONTRIBUTION TO KNOWLEDGE	382
7.4	IMPLICATIONS FOR PRACTICE	385
7.5	LIMITATIONS OF THE RESEARCH	387
7.5.1	Methodological Choices	387
7.5.2	Selection of Modes	389
7.5.3	Reflexivity	390
7.6	POSSIBILITIES FOR FURTHER RESEARCH	390

REFERENCES	392
APPENDICES	411
APPENDIX A: HOST SCHOOL'S SCHEME OF WORK	411
APPENDIX B: PUPILS ASSESSMENT SUCCESS CRITERIA	414
APPENDIX C: PUPILS ACTIVITY WORKSHEET	415
APPENDIX D: STAGE ONE LESSON MAPPING – LESSON ONE	418
APPENDIX E: STAGE ONE LESSON MAPPING – LESSON TWO	419
APPENDIX F: STAGE ONE LESSON MAPPING – LESSON THREE	425
APPENDIX G: STAGE ONE LESSON MAPPING – LESSON FOUR	429
PUBLICATIONS	438

List of Figures

Figure 2.1: Sequential progression of compositional processes through episodes

Fautley (2005, p.53). 'A new model of the group composing process of lower secondary school students' in the journal *Music Education Research*, © 2005 reprinted by permission of Informa UK Limited, trading as Taylor & Francis Group

Figure 2.2: Compositional model (Folkestad, Lindström and Hargreaves, 1997, p.6) . *Research Studies in Music Education* (9.1) pp. 1-13. Copyright © 1997 by Sage Publications. Reprinted by Permission of Sage Publications.

Figure 2.3: Partial transcript of a music score showing pupils music to speech interaction (Tomlinson, 2014, n.p.)

Figure 2.4: Language-based transcript of music composition (Huovinen and Rautanen, 2020, p.100)

Figure 2.5: Dimensions of children's music experience - open framework (Schmid, 2015, p.109)

Figure 4.1: Screenshot taken from Lesson Two: the pupils and teacher view of GarageBand

Figure 4.2: Screenshot taken from Lesson Two: the researchers view

Figure 4.3: Stage One of generating and framing the data. Partial lesson map of instances of non-verbal communication (Lesson One)

Figure 4.4: Stage Two of generating and framing the data. Partial representation of the mapping of resources available for communication (Lesson One Episode Eleven)

Figure 5.1: Camera orientation of the participants' seating positions

Figure 5.2: Screenshot taken from Lesson One at 02:01 – pupils' different resources of the modes of action and gaze

Figure 5.3: Screenshot taken from Lesson Two at 06:31 - Alex's hand gesture, 'thinking'

Figure 5.4: Screenshot from Lesson Two at 06:52 - Alex's hand gesture, 'knowing what to do'

Figure 5.5: Screenshot taken from Lesson Two at 10:50 - Alex operating mouse with hand gesture, 'searching'

Figure 5.6: Screenshot taken from Lesson Two at 11:16 - illustrating the pupils' individual designs for learning

Figure 5.7: Screenshot taken from Lesson Two at 16:52 - Alex's hand gesture, 'contemplation'

Figure 5.8: Screenshot taken from Lesson Three – Alex's transformation of resources to design for learning shown through the modes of gesture and gaze

Figure 5.9: Screenshot taken from Lesson Three: Episode Ten – Alex responding to pressure

Figure 5.10: Screenshot taken from Lesson Four at 27:39 - the pupils' signs of engagement

List of Tables

Table 4.1: Summary of the preceding modal prompts

Table 5.1: Summary of the lessons' analytical organisation and format

Table 5.2: The pupils' modes and the resources of modes available for non-verbal communication

Table 6.1a: Summary of short transformation of resources

Table 6.1b: Summary of multiple transformation of resources

Abbreviations

MIDI	Musical Instrument Digital Interface
n.p.	No page
Ofsted	The Office for Standards in Education, Children's Services and Skills

1.0 Chapter One: Introduction to the Thesis

The thesis considers the multimodality of 'silence' as it unfolds between two pupils' computer-based semiotic work in a music classroom in a UK state secondary school context. It pays close attention to the notion of how 'silence is naturally emergent' in educational contexts (Lees, 2012, p.54) and how music technology shapes multimodality and learning. As such, the thesis examines instances of non-verbal ('silent') communication to understand how different prompts (or 'signs') may support the pupils' design for learning in computer-based music composition.

In order to explore these ideas, I adopted a multimodal social semiotic theory of communication (Kress, 2010). The social semiotic framework is intended to provide appropriate methodological and analytical tools to identify the pupils' meaning-making and understand what semiotic work takes place. The study focuses on a computer-based compositional task, explored through mapping the experiences of two Year 9 pupils, aged 13-14.

Examining non-verbal communication in compositional activities in music education offers a different theoretical and methodological perspective from the other studies discussed in this chapter. I argue that using multimodal social semiotic theory offers a coherent and contemporary theoretical lens, one that draws together a range of theoretical resources from multimodal communication to understand the pupils' computer-based compositional work. Multimodal social semiotics asserts that spoken and written language has limitations and looks beyond language to examine multiple modes of communication and meaning-making (see Chapter Two); this study attends to non-verbal modes of communication in order to interpret signs of learning as the pupils' design for learning (Selander, 2008; Kress and Selander, 2012; Bezemer and Kress, 2016).

This introductory chapter explains how my interest in silence, multimodality and music education research has materialised, describes the educational context that the study considers (Section 1.1) and outlines the research questions and aims (Section 1.2).

Section 1.3 provides an overview of the chapters in the thesis. Section 1.4 provides a summary of the chapter.

1.1 Rationale

The study arose from my own professional practice as a former music teacher in both primary and secondary school settings and through work-based action research for my master's in education degree. In the secondary school setting, I had previously studied how pupils' communicative and collaborative processes affected the development of identity, learning and assessment outcomes (Rogoff, 2008) and pupils' use of talk in musical activities (Mercer, 2010). This exploration into pupils' compositional practices opened possibilities for further research, particularly regarding the role of technology and communication in computer-based music composition.

Since the early 1990s, pupils across Key Stages 1 to 3 were to, 'make appropriate use of information technology [sic] to create and record music' (Crown, 1992, n.p.). The place of technology in music education continued to be argued as both positive and negative (Mills and Murray, 2000; Pitts and Kwami, 2002; Cain, 2004; Wise, Greenwood and Davis, 2011; Himonides, 2012; Merrick, 2016) with pedagogical implications for the music classroom. These arguments regard the limitations of the equipment or software, for example, headphones preventing the teacher from hearing the pupils' music, or the software enabled pupils to copy, cut and paste. However, the dominant music curricula in England, at the time of this study, sustained the value and role of technology in facilitating music composition (English National Music Curriculum, Department for Education [DfE], 2013¹). My professional experience suggested that, although there had been research in music technology education in the UK (e.g. Mills and Murray, 2000; Pitts and Kwami, 2002; Dillon, 2003; Savage, 2007, 2010; Hewitt, 2008), it remained challenging for teachers to access and understand what is happening when pupils engage in computer-based compositional activities.

¹ This version was operational during the study's research period.

My role as a former music teacher provided first-hand experience of the phenomena I explore in the thesis. The following passage positions the problem of non-verbal ('silent') communication in a UK state secondary school context, of Key Stage 3 pupils' normal practice, in music education and computer-based composition.

It is possible to walk into a secondary school music classroom and hear nothing – no music, no sound. In this silence, questions arise as to what learning is taking place. Around the classroom are thirty pupils, sitting in pairs, facing the wall staring into a computer screen. They are all plugged into headphones with a separate MIDI and a QWERTY keyboard, as well as a mouse in front of them. On the computer screen, are moving images of a television programme called Dr Who. In observing one pairs' actions and interactions they seem to be engaged in a computer-based compositional activity. One pupil points to the screen whilst the other clicks the mouse and then plays something on the MIDI keyboard. The computer screen produces a coloured block from the pupils' actions, but silence still fills the room.

My curiosity in what was going on in the pupils' silences whilst they worked together continued to grow. I was fascinated in catching my pupils learning something through their non-verbal communication and tried to work out what that something was. As an observer and/or teacher in the classroom context the pupils' compositional silence was somewhat inaccessible. Here the pupils' modes of sound (referred to as computer-generated sound), gaze and facial expressions were invisible and inaudible from their seating positions and their use of headphones which is consistent with other research findings (Dillon, 2003; Hewitt, 2008).

Multimodality offers a dynamic and temporal perspective on learning. One's active engagement with others and with the environment will shape one's learning and outcomes (Kress and Selander, 2012). The process involves the interpretation and transformation of information using various modes and resources of modes, thus leading to the production of new representations of their understanding. An assumption of modes of communication is that it is possible to look at each mode and identify meanings being made, forming the concept of *signs of learning* (Bezemer and

Kress, 2016). The process of the new representation of understanding is known as a 'design for learning' and shows the learners agency, interests and choices in which learners are seen as designers and re-designers of these signs (Kress and Selander, 2012; Bezemer and Kress, 2016). In the context of my study, design for learning is an interpretive tool to help me theorise about pupil's communication through their choices and uses of different resources as they engage in a task (Kress, 2010).

The use of computers in music composition has extended the ways in which multimodality affects learning (Jewitt, 2013; Crescenzi, Jewitt and Price, 2014) along with new possibilities for how this communication can be represented (Bezemer and Kress, 2016). This means that more than one approach exists in which to understand the potential designs for teaching and learning (Jewitt, 2013). From a multimodal social semiotic perspective, modes of communication (e.g. gaze, movement or speech) are cultural resources shaped by social conventions and made available in communication to examine the processes involved in creating meaning. Resources of modes refer to the unique characteristics associated with the realisation of each mode, such as the intensity of gaze or the impact of a hand movement and thereby convey distinct meanings. Therefore, communication and learning are interlinked whereby signs of learning are considered an instance of communication (Kress and Selander, 2012, p.267).

The study is set within the context of practice in the English secondary school system in which music is a discrete subject area in the school curriculum (DfE, 2013a). In this study, I am giving recognition to silence, seen as the absence of speech, and I am exploring whether it holds significant meaning-making opportunities for two Year 9 pupils. I see the process of music composition as a multimodal act. I am looking at Key Stage 3 (ages 11-14) where computers, composition and music technology are considered commonplace in music classrooms (Savage, 2007, 2010; Himonides, 2012; Cooke, Evans, Philpott and Spruce, 2016). My study refers to the English National Music Curriculum (DfE, 2013; 2013a) that was operational and representative at the time of research, although the curriculum has since been revised into the Model Music Curriculum (DfE, 2021).

1.2 Aims and Research Questions

The research aims to contribute to understanding what goes on in the music classroom when pupils use computer technology to compose, focusing on pupils' instances of non-verbal communication. By taking a multimodal perspective on 'silence' that is, the absence of the mode of speech, this study aims to identify and explore communication involving a multiplicity of modes, and their available resources and offer a multimodal social semiotic account of the learning that occurs.

I am questioning the norms and expectations, namely instances of non-verbal communication and music composition that are often accepted in classroom-based music lessons, by making visible what is often ignored in music education. Fulfilling this aim involves an exploration of the pupils' communication during their instances of 'silence' and to examine how (and whether) their signs of learning contribute to their musical learning and knowledge in a (teacher-designed) computer-based compositional task.

These aims give rise to the main research question:

What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?

and sub questions:

- a) What is 'silence' significant of?
- b) What kind of semiotic work happens during instances of non-verbal communication?
- c) How do the modes involved in this non-verbal communication evidence learning?

I am making the assumption that silence is significant of communication. Here I am suggesting that learning potentially occurs during pupils' instances of non-verbal communication. Taking a multimodal research approach, this study considers the

pupils' sign-making and choices of modes and the resources of modes to represent non-verbal communication. There are no fixed modes or resources of modes as these are socially shaped by a community, a culture and history (Kress, 2010; Jewitt, Bezemer and O'Halloran, 2016). In the context of a secondary school music classroom, the mode of gesture has a diverse range of meanings in which a resource of the mode gesture, may be the pupil pointing at a worksheet. My study considers how these instances of non-verbal ('silent') communication materialise and give rise to distinct aspects of the pupils' musical learning, as well as making visible the connection between silence and multimodality.

1.3 Overview of the Thesis Chapters

In this chapter, I have provided an initial overview of my doctoral thesis study in which I have explained the rationale and aims and introduced the research questions. I have briefly introduced the multimodal social semiotic perspective on learning of this study.

Chapter Two presents a comprehensive review of literature across four research domains: non-verbal communication, silence, multimodality, and music education. Chapter Three explains how multimodal social semiotics will be operationalised in this study (Kress, 2010; Bezemer and Kress, 2016) and how the theoretical framework draws together elements from multimodal communication, silence and music to address the research question. The study's methodology, set out in Chapter Four, will provide an account of the methodological concerns for multimodal social semiotics which include data analysis and multimodal transcription. The potentialities and limitations of the analytical framework will be outlined. Chapter Five presents the findings and interpretations from sixteen instances of non-verbal communication by drawing attention to the mappings of the pupils' available resources. Chapter Six offers a further examination of the study's findings by continuing the discussion and reflecting on the research approach. The concluding chapter, Chapter Seven, brings together the main findings, analysis and reflections before finally drawing conclusions highlighting the significant contribution that this study provides. The chapter continues to consider the wider implications of the study's findings and provides recommendations for future research.

1.4 Chapter Summary

This doctoral research focuses on the multimodality of 'silence' as two secondary school pupils participate in a computer-based compositional task as a part of their ordinary music lesson. Drawing on a multimodal social semiotic theory of communication and learning (Kress, 2010; Bezemer and Kress, 2016), I am bringing together different theoretical and analytical tools, for instance, signs of learning (e.g. two-way communication) and designs for learning, to give 'silence' its salience. This means that I am giving recognition to silence, seen as the absence of speech, and will attend to the significance silence has in the pupil's non-verbal communication and their subsequent learning. This is resonant with the overarching research question which asks: What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?

As is customary within a multimodal approach, further questions will be asked of the data. This study has three sub-questions. The first sub-question addresses issues about what silence is significant of and assumes that it will involve some form of communication and learning. In order to explore those possibilities, the study poses two additional sub-questions. These additional sub-questions attend to the types of semiotic work the pupils engage in and how they aptly choose modes and resources of modes to show signs of learning.

2.0 Chapter Two: Review of Research Literature

2.1 Introduction

The literature chapter consists of eleven sections. A critical review of relevant literature locates this study within the fields of multimodality and music education. This study adopts a multimodal social semiotic framework that builds on previous research to address the challenge of understanding what happens during pupils' instances of non-verbal ('silent') communication during computer-based music composition. Section 2.2 provides a broad overview of non-verbal communication and explores how this is framed through music education and multimodal research. Section 2.3 examines the concept of silence, noting that non-verbal communication and silence have been researched through conversation analysis, multimodal discourse analysis and music education. Section 2.4 examines literature concerning different conceptualisations of learning to compose in the context of a secondary school music classroom and introduces a multimodal social semiotic view of learning. Section 2.5 reviews existing research that provides points of reference to composition with computer-based technology. Sections 2.6 to 2.9 reviews literature from four multimodal approaches: multimodal social semiotics (Section 2.6), multimodal interactional analysis (Section 2.7), multimodal discourse analysis (Section 2.8) and, lastly, conversational analysis with a focus on social interactions and conventions of speech (Section 2.9). Section 2.10 examines research in music education that draws on multimodal theory combined with other theoretical frameworks, such as sociocultural theory, ecological systems and kinaesthetic learning. The chapter's conclusion (Section 2.11) highlights the challenges and potential contributions this study could bring to the fields of multimodal social semiotics and music education, specifically in computer-based composition.

2.2 The Research Domain of Non-verbal Communication

A number of scholars have recognised the critical role of non-verbal communication in the wider disciplinary field of human communication (Darwin, 1872; Birdwhistell, 1952; Hall, 1959; Bateson, 1979; Mehrabian, 1981; DePaulo and Friedman, 1988; Kress and van Leeuwen, 2001). Whilst non-verbal communication has its roots in anthropology,

drawing on the studies of Birdwhistell (1952), other disciplinary research fields have embraced and extended the study of non-verbal communication to include psychology, linguistics, communication, multimodality, education, media and music amongst others. The main challenge facing researchers has been identifying the characteristics of non-verbal communication, especially where the centrality of verbal communication remains a consistent focus in the research on multimodality and music education.

Recent research in the UK and Europe, has established different concepts of non-verbal communication, including non-verbal behaviours (Mehrabian, 1981) and body language (Kress and van Leeuwen, 2001; Eunson, 2012; Fontenot, 2021). Categorisation of what counts as non-verbal behaviour and body language has proven (to be) somewhat contradictory and researcher dependent. Eunson (2012) suggests that body language communicates emotions and ideas which become apparent when examining the body's physical behaviours such as posture and gesture. Eunson's (2012) example uses imagery of actions performed by a mime artist showing that the audience's interpretations and emotions, as well as the artist's, are present during the interaction. In contrast, Fontenot (2021, n.p.) cites Mehrabian's (1981) study which defines four non-verbal behaviours associated with an individual's attitudes, emotions and preferences, expressed as categories of non-verbal communication. These non-verbal behaviours are also referred to as implicit communication and include:

- pleasure – displeasure;
- dominance – submissiveness;
- liking – non-liking; and
- arousal – non-arousal.

Dickson and Hargie (2003, cited in Eunson, 2012, p.286) identify nine additional instances of how non-verbal behaviours can be communication, of which two are notable. The first of these considers the replacement of verbal communication in situations where it may be impossible or inappropriate to talk, whereas the second contextualises interaction as observed from, and within, the social setting. Research shows that these two particular types of non-verbal behaviour are often found in educational contexts (Lees, 2012; Bezemer and Kress, 2016). These two types of non-

verbal behaviour further align with assumptions of multimodality where meanings in communication are recognised as being socially and culturally constructed. As such, within the context of a music classroom, examples may resemble policy (pupils line up quietly outside the classroom prior to their lessons) or something that is considered a part of that cultural set up (during ensemble work where a conductor raises their baton to signify a musical starting point and commanding silence). In both instances, the examples could be considered as an expected behaviour (Lees, 2012).

The term 'non-verbal communication' is derived from anthropology and the notion of *kinesics* which was largely concerned with interpersonal contributions (Birdwhistell, 1952). Kinesics is defined as, 'the study and interpretation of human body movements that can be taken as symbolic or metaphorical in social interaction' (Padula, 2009, n.p.). Mehrabian (1981) and Eunson (2012) assumed that something had been communicated through physical movement when actions, rather than words, were prominent. Similarly, other researchers define non-verbal communication as an exchange of wordless messages (Fontenot, 2021) or unspoken dialogue (Burgoon, Guerrero and Floyd, 2016). Non-verbal communication is accepted to materialise using gestures, body movement, facial expressions, eye contact and proxemics (defined as how people use space).

Two core strands weave through the different research domains exploring non-verbal communication. The first is that interaction of some kind is always present, whether using gestures or facial expression; both have a significant purpose and value in human communication systems where social and cultural setting support interpretation. The second core strand is that regardless of whether communication is verbal or non-verbal, these systems appear to interlink with linguistic conventions where the function of 'signs' and 'signals' is necessary to interpret communication (Kress and van Leeuwen, 2001).

2.2.1 Non-verbal Communication in Music Education

In global instrumental music studies, research on non-verbal communication directs attention towards interactions between the body movements, gestures and facial

expressions of musicians and their instruments and performances which in turn, signal communication and meaning-making (Marchetti and Jensen, 2010; Davidson, 2012, Duffy and Healey, 2014; Pipe, 2015). There are also examples of psychology studies where emotions and the effects of music are discussed (Hallam, 2010) or one-to-one instrumental music performance instructions (Kurkul, 2007). Psychology studies have also explored paralinguistics where vocals and musical elements are considered in music therapy (Silverman, 2008). These psychology studies show possibilities in understanding the availability of different modes, but the studies are contextualised outside of a music education setting and focus more on 'inner signs' (Kress, 2010) without consideration of the different multimodal approaches.

To date, relatively little is known about the significance of non-verbal communication in computer-based music composition. Battersby (2009) and Battersby and Bolton (2013) argue that a teacher's non-verbal communication, such as body movement (kinesics), in a music classroom could impact pupils' engagement and learning. Their research recognises the critical role of teacher-pupil relationships and interactions rather than focusing on specific music-based activities. Furthermore, a large number of published studies in music education focus on pupils' dialogue during their compositional work (e.g. MacDonald and Miell, 2000; Dillon, 2003; Burnard and Younger, 2008; Gall and Breeze, 2008; Hewitt, 2008; Mellor, 2008). Some of these studies do, however, report on non-verbal behaviours (MacDonald and Miell, 2000), an array of communicational modes, e.g. talk, visual and gesture (Gall and Breeze, 2008) and relevant non-verbal actions and/or responses (Dillon, 2003; Burnard and Younger, 2008; Mellor, 2008). These are discussed further below. Although attention has been given to non-verbal communication, verbal communication and dialogue has inherently been the dominant focus and determinants of pupils' different compositional practices.

Non-verbal communication plays a significant role in music-making, for example as demonstrated by the work of (UK scholars) MacDonald and Miell (2000), whose study focused on friendship groupings and communication. They found that non-verbal communication contributed to:

- enhancing the quality and quantity of musical ideas;

- enhancing the cohesion and coordination of the group;
- enabling expression of the composers' emotions, attitudes, and preferences;
- influencing musical choices of others; and
- facilitating the resolution of conflicts and disagreements.

For example, 15 pupils with special educational needs and disabilities created a piece of Gamelan music in which the drummer played varying rhythms that signalled and cued when the other participants could contribute their rhythmic responses. Although the data identified pupil talk as being relevant to their engagement, non-verbal communication and the orchestration of aural and visual modes were considered more significant in composing, reporting improvements in the pupils' communication and musical skills. MacDonald and Miell (2000, p.59) suggested that musical participation was a form of non-verbal communication that involved the expression and interpretation of affect, intention and meaning.

Recent studies began to highlight the significance of non-verbal communication in music composition, with common themes including collaboration and the role of technology (Burnard and Younker, 2008; Gall and Breeze, 2008). While both studies discuss the role of technology in music composition, Burnard and Younker (2008) focused on traditional musical instruments whereas Gall and Breeze (2008) examined the use of music software. In addition to the inclusion of verbal communication in the studies' research design, as evidenced by transcripts, they emphasised the significance of non-verbal communication (e.g. facial expressions, gestures, body language and physical distance) in music composition that conveyed information and meaning beyond words.

In Burnard and Younker's study (2008, pp.68-70) the non-verbal element was embedded in the transcripts alongside larger sections of speech. The speech showed the pupils' conversations and decision-making processes whereas the action described their playing and emotions. For example, in the UK secondary school data set of 30 pupils, observation showed that when working in groups of four, if one pupil demonstrated an idea, the two other pupils *listened intently* and the actions of one pupil was not recorded or explained in the data (emphases added). Similarly, Gall and Breeze (2008, p.34) provided transcripts that indicated how two pupils' talk, and gestures directed at the

computer screen were integrated into and further supported their computer-based compositional work. In both instances the studies found that non-verbal communication, such as gestures, positively reinforced verbal messages or acted as a means to coordinate and to regulate compositional collaboration among group members.

2.2.2 Non-verbal Communication in Multimodality

This subsection briefly considers how non-verbal communication in multimodality developed through Saussure's theory of semiotics (1974) to Kress's (2010) theory of communication. It is not a complete historical account but introduces the concept and use of 'sign' and non-verbal communication. Communication relies on 'signs' or 'prompts' and for this, Saussure's theory of semiotics (1974) needs to be considered along with Halliday's metafunctions (1978) and the semiotic terms 'signifier' and 'signified'.

Tracing back to Saussure (1974), the system of signs initially focused on spoken language, where the signifier and the signified were interdependent, focusing on a concept and acoustic sound, e.g. the short 'a' for apple (Chandler, 2017). Taking a materialistic perspective of signifier, Barthes (1967) expanded Saussure's system of signs to further include objects and images, such as photographs. Multimodal literature often refers to language orientated findings which strongly suggests, 'speech is important in human interaction' (Jordan and Henderson, 1995, p.48). However, recent multimodal research shows extension beyond the written and spoken forms of language (Jewitt, 2011, 2011a; Bezemer and Kress, 2016; Mondada, 2019).

Without our interpretations of signs, we are unable to make sense of the world in which we interact and communicate, and meanings become lost (Chandler, 2017). A 'sign' could be a literal and physical object, a response, an action or reaction, e.g. holding a door open and gesturing that someone passes through which shows how two people understand and exchange meanings in a given context. However, in understanding the purpose of 'sign' Kress (2010) questioned the representational and communicational aspects: how the sign has been produced, and what does it mean? Meaning-making in

this sense expands the earlier model of linguistics in an attempt to explore other communicative expressions such as icons, font, colour, gaze and gesture which are known as 'modes' (Kress, 2010).

Within the field of multimodality, the theorising of sign systems has evolved and more recently adopted a different, and usable, perspective in connection with social semiotics. This complexity is illustrated through several diverse views within the field of multimodality. One view maintains that non-verbal communication is associated with the principles of linguistics (Scollon and Scollon, 2011), whereas Iedema (2003) pointed out benefits of understanding people's meaning-making when language was not at the centre of all communication. However, Mondada (2014) takes the position that multimodality, embodiment and non-verbality within multimodal conversational analysis to some degree overlap but also correlate with language, talk and other resources. From the perspective of multimodal communication, Jewitt (2011, p.17) and Bezemer and Kress (2016) corroborate Iedema's earlier point, unequivocally suggesting that most of our communication happens without speech. Complementary to these views, further research suggests that non-verbal communication ranges from 60 percent (Birdwhistell, 1952) to 75 percent of all human interaction (Burgoon et al., 2016), thereby giving non-verbal communication its salience.

2.3 Examining how Silence is Portrayed (across the Literature)

The purpose of this section is to examine how silence is portrayed across research and historical literature focusing on how we, as human beings, researchers, teachers and participants understand and experience silence. This section does not intend to give a complete overview of silence, rather it focuses on the following two areas: how silence has been studied in different research fields (conversational analysis, music education and multimodality) and the diverse ways in which it is defined.

Silence has been considered through the phenomenological and metaphysical analyses of Dauenhauer (1980) and Picard (2002), whose perspectives differ from those of educational researchers such as Mercer (1995) and Jaworski (1993) who, although primarily focused on verbal interaction and talk, do identify *silence*. Dauenhauer (1980,

p.110) drew inspiration from the Chinese philosophies and teachings of Buddhism, Taoism and Confucianism and summarised that, 'speech and silence are correlative concepts'. Picard (2002) too conveys that silence emerges when speech is absent:

SILENCE IS not simply what happens when we stop talking. It is more than the mere negative renunciation of language; it is more than simply a condition that we can produce at will. (Picard, 2002, p.15, original emphases)

The work of Dauenhauer and Picard presents an argument similar to that outlined in some research on multimodality (Section 2.2.2), whereby in communication, there is a mutual relationship between speech and silence, with one not existing without the other. This means that a conversational gap likely exists between participants' discussions, questions or comments that could lead to a deeper understanding of communication beyond language (Picard, 2002). What that something is, remains undetermined and unspecified at each conversational turn (Picard, 2002; Lees, 2012) and conceptually holds value in what pupils can achieve in their learning. Therefore, from a multimodal perspective, there is some connection between conversational gaps, the concept of signs and silence, where meaning-making will be continuous (Kress, 1997).

Verbal interaction, talk and utterances in the classroom have been widely researched (for example, Duez, 1982; Mercer, 1995; Jaworski and Sachdev, 1998; Ingram and Elliott, 2014) but much work on silence comes from their studies' analyses and shares a common finding that talk generates moments of silence. These silences are depicted differently, but each definition offers variation as to how they contribute (or not) to pupils' learning. For instance, Jaworski and Sachdev (1998, p.274) discussed silence in the context of a classroom as the absence of pupils' *relevant talk*. Their research suggested that pupils believed silence was purposeful, and necessary, in learning activities which similarly reflected the pupils' perceptions of the right learning conditions or environment (Jaworski and Sachdev, 1998). This type of silence requires the participants' involvement in the communication and regards them as knowledgeable in complying with the teacher's pedagogical or behavioural expectations (Ollin, 2008), whereas a teacher may view silence negatively (Lees, 2012), or, as Kurzon

(2007, p.1676) illustrates, a pupil may be unintentionally silent through their non-presence in a classroom activity (e.g. sitting back and doing nothing). These researchers exemplify the way that silence can be seen as a means of communication but is dependent on understanding the context and participants' perception (Jaworski, 1993).

Alternative research has examined silence in everyday conversations found in the context of a school classroom (Rowe, 1974; Sacks, Schegloff and Jefferson, 1974; Tobin, 1986; Maroni, 2011) further evidencing three distinctive forms of silence, 'the gap, the lapse and the pause' (Maroni, 2011, p.2082). These three features occur in conversations, and during turn-taking moments where: the gap indicates the movement of one speaker to another; the lapse shows the conversation has ceased and the pause signifies a period of waiting, such as waiting for a response to a question (Maroni, 2011). Bilmes (1994, p.79) categorises one aspect of silence as '*conversational silence*' which refers to the absence of talk but acknowledges that relevant and purposeful talk may surround its existence. Therefore, this definition of silence provides a useful similarity to and interpretation of the type of silence described in Chapter One (pp.14-16), in which a multimodal social semiotic perspective takes 'silence' to mean the absence of the mode of speech.

The American cultural and linguistic anthropologist Basso (1972), undertook research on Western Apache society, argued that a person's cultural background or status in a community could mean that they adopt silence in their verbal communication as a way of demonstrating uncertainty. Expanding on this notion, Braithwaite (1990) suggested that silence in interpersonal relationships determined relative lack of power, where the quieter person exhibited less power, whether in terms of knowledge or in status. Silence can be further regarded as, 'a sign of hostility or sympathy, agreement or disagreement, fear or pleasure, presumption and snobbery or empathy and complicity' (Maroni, 2011, p.2083). While this is not an exhaustive list, it does emphasise that during people's *conversational silences* additional meanings may be available.

The literature review so far has indicated that numerous scholars have sought to understand communication both verbal and non-verbal, how silence can be interpreted and its place within different theoretical frameworks. It is apparent that the centrality

of verbal communication has been a consistent research focus across many different fields and disciplines, and it is timely to consider other forms of communication that occur in silence.

2.3.1 Silence in Music Education

There is a limited selection of recent research that examines pupils' non-verbal communication in music education and fewer that analyse silence in computer-based compositional tasks framed theoretically by multimodality. This section considers how non-verbal communication and/or silence has formerly been researched in music education with the purpose to establish existing gaps in literature and identify how a contemporary perspective on communication may be of value.

2.3.1.1 Silence as a part of the Compositional Process

The following two studies by Kratus (1989) and Seddon (2001) gave silence its salience through their methodological and analytical approaches in which silence was recognised as a part of the compositional process.

Kratus's (1989) study of 60 American primary school pupils aged 7, 9 and 11, analysed participants' keyboard-based compositions identifying four compositional processes of exploration, development, repetition and silence. Silence was defined as no musical sound being heard but there could be researcher and/or participant talk. However, it was unclear whether, in these apparent silences, the pupil asked questions to the researcher or teacher, or just paused to internalise thoughts and ideas. The drawback of Kratus's definition shows that talk and silence were considered alike. A more fine-grained analysis of the silences might have revealed which reason was the case. Silence existed within all of the participants' compositional activities (with mean percentages ranging from 6.3 percent to 10.5 percent) and reported no significant differences in how silence was used, thus evidencing that silence is worthy of further study (Kratus, 1989, p.11).

Methodological concerns regarding Kratus's (1989) study were the controlled context of one pupil and one keyboard, the omission of pupils who had had prior instrumental experience and restricting the pupils to ten minutes to compose something. This particular scenario does not reflect the reality of a typical Key Stage 3 music classroom in secondary schools, in which pupils will usually work at a keyboard in pairs over an hour-long lesson (Savage, 2010; Breeze, 2011).

In contrast, Seddons' (2001) two pilot studies of three Year 9 pupils and then four Year 9 pupils in a UK secondary school, considered the participants' engagement in a computer-based music composition. Moments of silence were defined as those lasting for more than five seconds which also included no computer mouse movement. The analysis identified and coded silence as one of five compositional activities, the others being: playing the keyboard, recording, playback and editing. However, the published account offers little explanation of how silence contributed to the compositional activity, just that silence was associated with no mouse movement and a time interval. Using a multimodal framework would critique this by assuming that other compositional activities were simultaneously occurring with the lack of mouse movement. Furthermore, Seddons' main study of 48 Year 9 pupils in Cheshire, showed the compositional activity of silence became unimportant as it was removed from the analytical coding and findings. Like Kratus (1989) Seddon appears to assume that silence indicates the absence of composition.

The approach of coding silences longer than five seconds as a variable in composition aligns with conversational analysis, where such pauses could represent a lapse in speech or moments of contemplation. However, as previously argued (Section 2.2), interaction is always present in non-verbal communication, suggesting that these studies may have narrowly focused on the audible aspects of composition (Kratus, 1989, p.8). This raises the question of whether other compositional activities occur during these silences, such as pupils contemplating their next musical move or observing their peers for cues. The term 'process' refers to these broader activities and non-verbal communications that contribute to the pupils' compositional work.

While both Kratus's and Seddons' studies referred directly to silence, as a category and as a part of the compositional process, silence was defined differently. Furthermore, neither study captured the participants' non-verbal communication, such as a glance in the direction of the MIDI keyboard or a shift in body posture towards another participant. A multimodal social semiotic framework could examine non-verbal modes and help us to understand the significance of these apparent silent communications during composition.

2.3.1.2 Frequency of Compositional Activities and Time Analysis

This subsection considers how non-verbal actions were portrayed in two instrumental compositional studies (Fautley, 2005; Biasutti, 2012), rather than computer-based, and discusses how silence was only tangentially noted.

Fautley (2005) argued that the process of group compositional activities was more important than an overall product. The model advocated was aimed at supporting the teacher's understanding of the pupils' activities whilst illuminating the processes within each compositional phase. Fautley's model took a cognitive psychological perspective that aligned with Webster's (1988, p.182) conceptual model for creative thinking and supported Vygotsky's notion of social development.

Fautley (2005, pp.43-45) outlined the role of a pupil within a group dynamic as either individual, shared or distributed in which each role related to different components of composition. There was an assumption that non-verbal actions were more likely to occur during the compositional stage of 'transformation, extension and development' in which pupils explored musical ideas using non-verbal modes in activities, such as trialling or rehearsal.

Figure 2.1 emphasises the complexity of group composition through the distinct phases with their frequency. It becomes apparent that 'work in progress performance' - labelled as WIPP manifested the most. However, Fautley's model does not directly outline where silence or non-verbal interactions may materialise. For instance, 'work in progress performance' was suggested as a complete run-through (Fautley, 2005,

p.49). As an activity, there is an assumption that a run-through would involve non-verbal interactions and communication (Haviland, 2011). However, since Fautley did not mention the significance of non-verbal interaction, it warrants further exploration.

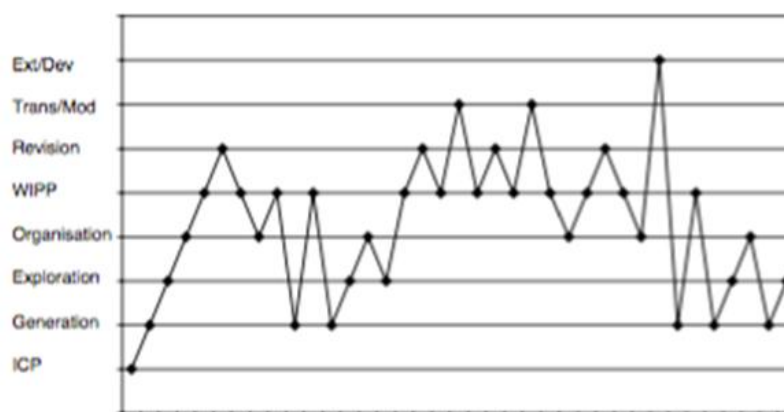


Figure 2.1: Sequential progression of compositional processes through episodes
Fautley (2005, p.53)

In comparison, Biasutti (2012) reported the compositional activities of an Italian rock band comprising of three adult members, all of whom had musical backgrounds. The study's theoretical underpinning combined group creativity with research on collaborative compositional processes and elements of an informal learning approach (Green, 2001). Five compositional themes were identified: context definition, experimenting, constructing, playing and evaluation.

Of the five themes, Biasutti (2012) reported that 35 percent of time was spent in the construction phase. Within the description of construction, four behaviours were mentioned (organising, chaining, adapting and revising) and, like Fautley (2005), there was a vagueness attached to the descriptor's activities. For example, within the category of construction, organising referred to how, where and when a musical principle would be implemented into the composition (Biasutti, 2012, p.350). However, what was unknown was the extent that non-verbal actions were a part of the compositional activities or whether any meaning was assigned to 'silence' in these categorisations.

This section has examined two studies (Fautley, 2005; Biasutti, 2012) showing that non-verbal actions and/or interactions were remotely alluded to as being present in

compositional activities. The studies offer the potentiality of addressing a gap in the literature, namely that the significance of non-verbal actions in music research have not yet been fully considered.

2.3.1.3 Pupil Talk Diminishes over Time in Composition

Focusing on the notion of silence becoming visible, this section examines findings from three computer-based compositional studies where participant talk diminished as the task progressed (Dillon, 2003; Gall and Breeze, 2008; Hewitt, 2008). These studies had slightly different research perspectives; one examined dialogue whilst observing non-verbal actions during compositional tasks (Dillon, 2003), Gall and Breeze (2008) examined pupils' collaborative learning through their mediated actions of computer-based music composition and Hewitt (2008) explored instances of transactive communication whilst mentioning non-verbal behaviours. Each study considered their participants' computer-based compositional activities as they engaged in making decisions, from the available resources. Respectively, these were noted from observations, video recordings and interviews. However, non-verbal findings were reported differently and in the cases of Gall and Breeze (2008, p.36) and Hewitt (2008) further analysis focused on pupils' on-screen visual representations and manipulations.

Dillon (2003) provided an in-depth account of non-verbal actions about participant engagement in different activities, for example, *searching for* and *selecting* music samples were reported as *clicking and listening* to them before coming to a joint decision (Dillon, 2003, p.895). Gall and Breeze (2008) noted pupils' negotiation, meaning-making and collaboration were enhanced when they analysed modes of communication (i.e. gaze and gesture) alongside their use of computer-based technology. For example, negotiation seemingly centred around the on-screen visual representation in which *pointing* at the screen was evident. In comparison, Hewitt (2008, p.14) adopted Kruger's (1992) definition of transactive communication where the scope of the study included how interactions of conflict-resolution manifested in the pupils' friendship groupings, musical attainment and ability to compose together at the computer. These non-verbal behaviours were described as functions that contributed towards the composition's progress, for example, *play my melody* in which the pupil

would have played back the composition. Similarities can be seen between the works of Dillon (2003); Gall and Breeze (2008); Hewitt (2008) and Burnard and Younker (2008; Section 2.2.1) in which their transcripts simply describe the pupils' compositional activities.

These studies showed areas of agreement in their findings, namely that as the composition progressed verbal interactions diminished. Gall and Breeze (2008, p.36) established that pupils dialogues do not consistently occur throughout the music composition process. This inconsistency raises questions into how researchers can interpret pupil interactions during the non-verbal periods of music composition. Hewitt (2008, p.24) stated that one drawback of the analytical focus was being unable to 'make the non-verbal aspects of the collaborative relationship evident'. Despite transactive communication being the study's focus, Hewitt (2008) noticed, in some pupils, that as the series of music lessons progressed the dialogue decreased, to the extent that almost 50 percent of the compositional time was completed through non-verbal interaction. Similarly, Dillon (2003) observed that extended verbal reasoning was not necessary to complete the task and in fact conflict-based interactions or actions were mediated through the computer as music or non-verbal actions.

The methodological approaches of exploring collaborative and creative thinking (Dillon, 2003; Gall and Breeze, 2008) and collaborative behaviour (Hewitt, 2008) are similar in that they were able to identify whether a pupil would develop their compositional work through speech or action. However, speech was the dominant focus, and their findings often supported this perspective in which non-verbal action and non-verbal behaviours were seen as being complementary. This suggests that within the pupils' non-verbal action and/or non-verbal behaviour there is available data which can be analysed to provide insights into the pupils' compositional activities.

2.3.2 Silence in Multimodal Research

Little research has been conducted into silence across the field of multimodality. However, there are three existing studies worthy of consideration (Bezemer and Kress,

2016; Heath, Luff, Sanchez-Svensson and Nicholls, 2018; Mondada, 2019) and these are addressed next.

The first mention of 'silence' in multimodal research was cited by Bezemer and Kress (2016), in which the original research was attributed to Jewitt (n.d.). In their study, the body posture and gaze of a silent female pupil during an English lesson was examined using a social semiotic framework. Silence was contextually situated where the pupil was verbally silent even though her participation in class and the task was active. Two suggestions were offered to account for the pupil's silence which pertained to her status as 'a new pupil' to the class and possibly with English as an additional language (Bezemer and Kress, 2016, p.41). The theoretical point emphasised by this example introduces the notions of context and 'signs of engagement'. These signs of the pupil's engagement were noted through three different actions:

- the orientation of her posture;
- the direction of her gaze whether at the text, teacher or others in the classroom; and
- her interaction with the textual resources, (i.e. a worksheet) alongside gaze and hand movements.

It could be argued that the temporality of the task, as well as any number of potentially different configurations of the pupil's actions, could have contributed to her signs of engagement. The consistent element here is 'silence' and the fact that silence was meaningful to the pupil. A subsidiary point in connection with the extract, acknowledges how these silent moments and findings were reported. As such, the entire instance of silence was annotated through a series of five hand-drawn sketches alongside a written account. The written account attended to the pupil's signs of engagement which were indicative of the modes and their resources, of posture, gaze, gesture and interaction with the text. A wider breadth of analysis could have included the classroom layout, e.g. table groupings within the classroom environment as well as understanding of how the text contributed to materials being taught. Consequently, the extract explores a range of factors that influence how the pupil's learning was shaped by the semiotic resources

and through her 'silence'. It addresses how moments of silence can be researched and by adopting a fine-grained approach, can be analysed.

In contrast to Bezemer and Kress (2016), Heath et al. (2018) and Mondada (2019) transcribed silent actions from the theoretical perspective of multimodal conversational analysis. Heath et al. (2018) combined multimodal conversational analysis with ethnomethodology to show how surgical assistants anticipate a surgeon's embodied actions whereas Mondada (2019) used traditional conventions in which pauses, gaps and lapses in speech indicated silences. Although these studies are not classroom-based, they both show how silence exists in people's embodied social interactions when speech is absent. Noteworthy, both studies report similar analytical procedures in which their respective focuses are of the non-verbal embodied interactions. However, the focus in this review is more on Mondada's (2019) study, not only because it is the most recent publication, but also because the analytical approach considers pauses, gaps, and lapses, sharing continuity with other research (Haviland, 2011; Maroni, 2011) that recognises non-verbal communication between the manifestations of sound and speech.

In Mondada's (2019, n.p.) study, two questions of silent moments are asked:

- How are embodied and verbal resources distributed within a situated activity, when moments of talk alternate with moments of silent action?
- How should the sequential organisation of silent actions be accounted?

In order to address these questions, video-recorded excerpts of a customer and shop worker exchanges were examined. This allowed for a fine-grained analysis of the customer's verbal requests, their actions and the silent responses of the shop worker who silently retrieved an object for the customer. The transcription, which includes both video stills and the sequential and temporal actions of the participants, later becomes a useful semiotic text showing where and how silence is incorporated in embodied action. It is clear that both video and fine-tuned transcripts are necessary to examine the participants' actions. Throughout Mondada's (2019, n.p.) study, examples are provided of interactions between customers and shopkeepers to reveal the notion

of what is considered as normal practice in shopping. One example given illustrates how in Switzerland, it is customary practice for exchanges and actions to be conducted in almost complete silence and where speech only happens at the beginning and end of the interaction.

Bezemer and Kress (2016) note that not all interactions or signs of engagement can be attributed to verbal prompts, as some prompts may be in response to other non-verbal actions. This means that the framing of prompts requires consideration as it could have implications for the 'unit of analysis'. However, Mondada's (2019) study provides a different approach in which an instance of non-verbal communication is identified as being in-between the verbal mode of speech.

2.3.3 Summary

Section 2.3 has shown how *silence* is represented across different research fields, including conversational analysis, education, music education and multimodality. Not surprisingly, the literature shows that verbal communication is the most commonly studied mode of communication. Ample evidence exists to support the view that silence and non-verbal communication consists of signs, or messages, that when interpreted transmit meaning (Kress and van Leeuwen, 2001; Kress, 2010). In music research, it is also true pupils use silence and non-verbal communication as a means to communicate compositional ideas and decisions (Kratus, 1989; Seddon, 2001). Music studies that examine talk and non-verbal communication (Dillon, 2003; Hewitt, 2008) found that at least 50 percent of pupils' communication occurs in silence. However, in music education and multimodal social semiotics 'silence' has received less attention with a scarcity of studies illustrating instances of non-verbal communication in classroom settings (Bezemer and Kress, 2016).

2.4 Conceptualisations of Learning to Compose in the Context of Secondary School Music Classrooms

In the broader field of education, educational theorists and philosophers consider learning to be a complex and multifaceted process (e.g. Dewey; Piaget; Bruner; Freire,

as cited in Aubrey and Riley, 2018). Learning has been theorised from different perspectives, for instance behaviourism, cognitivism, constructivism and sociocultural theory. From a psychological perspective, learning has been described as both a process and a product. For example, behaviourist psychologists like Pavlov and Skinner saw learning as a change in a pupil's observable behaviour often determined by their interaction in the environment. Cognitive and constructivist approaches focus on individual learners and how they form concepts. However, in sociocultural theory learning is viewed as a social process, in which knowledge is shared and situated.

Although behaviourism provides a clear framework for observable changes it is critiqued to neglect pupils' internal cognitive processes. In contrast, cognitivism and constructivism offer insights into mental processes and prior knowledge but these may be challenging to observe in research. Sociocultural theory's focus on social interaction and context is relevant in collaborative settings but may overlook individual differences.

The study of music education is also a complex field that encompasses a variety of approaches and perspectives. Research in music education echoes the complexities of learning in general education, showing that learning music in schools has been examined through many lenses, including: developmental psychology (e.g. Hargreaves and Lamont, 2017), social and cognitive epistemologies (e.g. Elliott, 1995), and creativity (e.g. Dewey, 1902; Wallas, 1926). Fautley and Savage (2013) and Cooke et al. (2016) write extensively about these competing theories, guiding the secondary school music teacher on pedagogical implications of teaching and learning using these approaches. For instance, music teachers might use constructivist approaches to plan lessons that build on pupils' prior knowledge and experiences, while incorporating sociocultural strategies to foster collaborative learning and knowledge sharing.

While developmental psychology offers insights into the stages of musical development, it may not fully account for the social and cultural factors influencing learning. Similarly, social and cognitive epistemologies offer deep insights into the mental processes involved in learning music, but from a researcher's perspective, capturing this data can be challenging due to the complexity and variability of cognitive processes. Creativity-focused approaches emphasise the importance of fostering innovation and originality in

music education. However, school structures and policies (Wallas, 1926; Webster, 1988; Bauer, 2014) do not provide adequate time to enable pupils to develop improvisation and composition skills to their fullest. Often the importance of pupils' non-verbal communication is overlooked in musical activities and instead, verbal and written communication (or musical product) is considered an important factor in determining pupils' development. Nonetheless, Haviland's (2011) study emphasises the significance of non-verbal communication, such as body language and musical gestures, showing how they contribute to a pupil's musical understanding and engagement in the classroom.

In the field of music education, defining what it means to learn to compose music presents challenges due to the variety of cultural and educational perspectives and approaches. A recent publication by Devaney, Fautley, Grow and Ziegenmeyer (2024a), suggests there is still contention about how teachers and researchers conceptualise learning to compose in music classrooms. For instance, in Croatia, the music curricula expresses composing as 'music creativity' or 'music making' (Vidulin, 2024, p.76), while in Scotland, composing was initially termed 'inventing' before being reinterpreted as composing, arranging and improvisation (Jaap, 2024, p.476).

However, numerous scholars precisely state how learning to compose music is defined in their studies, often referring to the process or product (e.g. Webster, 2011; Phillpott, 2016; Devaney et al., 2024a) or by detailing a compositional model (e.g. Fautley, 2005). For instance, Philpott (2016, p.32) explained that learning is evidenced 'by changes in pupil's behaviour, attitudes, or values, which occur through the acquisition of different types of musical knowledge'. In contrast, Devaney et al. (2024a) emphasise that learning to compose music inherently involves the simultaneous creation of new musical ideas and define composing as:

When we say the word 'composing', we mean the activity in its broadest sense: any processes, individual or collaborative, which bring into fruition any kind of music, whether this be realized directly into sound, whether or not it has been notated, and whether or not it has an audience. (Devaney et al., 2024a, p.1)

Webster (2011) questioned whether compositional processes had changed in light of advancements and the use of computer-based technology in music classrooms. While there are differences in the definitions of learning to compose in music education, composing needs to meet the needs of the English National Music Curriculum (DfE, 2013) and more recent policies, such as the Model Music Curriculum for Key Stage 3 (DfE, 2021) and the National Plan for Music Education (Crown, 2022). Therefore, it is difficult to provide a definitive stance on learning to compose, particularly given the varied definitions and differing pedagogical perspectives on composing, and the ever-evolving nature of music technology, which continues to reshape the landscape of computer-based music composition.

2.4.1 Implications of Social Constructivism in Music Composition

Through the perspective of social constructivism, learning to compose in music education requires attributes of musical information, problem-solving and active participation (Webster, 2011; Shively, 2015). In the UK, music education began to focus on creativity or 'inventing music' in the 1970s. This integration was influenced by the research of Paynter and Aston (as cited in Grow and Ziegenmeyer, 2024, pp.377-378) and policy efforts, such as The Plowden Report (1967). The report stressed the value of 'learning through process, exploration and experience'. Today, this perspective of creativity and learning to compose remains relevant. According to Fautley (2024), creativity and composing are connected. He suggests that creativity is the ability to think and innovate in which creative thinking involves ones' persistence, experimentation and analytical skills. However, composing is the application of that creativity.

Learning to compose assumes that learners will construct (or build upon) their knowledge as they interact with others in social contexts (Wiggins, 2016). This implies that learning to compose focuses on pupils' meaning-making when the conditions of talk and participation occur together. Wiggins (2016) further proposes that these conditions of learning are subject to the teacher providing the appropriate contextual setting with authentic experiences, scaffolding and empowering the learner voice and agency.

Scott (2006), however, makes a case for musical learning to represent the learner's ability to contribute and interpret meanings based on their musicality, knowledge and prior experiences in the world. This definition of learning is similarly reflected in the work of Webster (2011, p.37), who suggested 'learning by-doing' is insufficient to constitute meaningful learning in music. These interpretations draw on Vygotskian theories in which social interactions, collaborations and negotiations are as important in learning as Piaget's theory of development. This interpretation naturally transitions into the research field of multimodality, a concept that expands the scope of learning and communication beyond verbal exchanges, encompassing multiple modes of meaning-making, such as visual, auditory, gestural and spatial.

Yunker and Smith (1996, p.25) defined learning to compose as 'the process (not product), knowing (not knowledge), active involvement (not passivity), and discovery (not memorization)'. They examined four participants' cognitive processes of composition using a 'think-aloud' approach. Each participant approached composing using a similar process of learning consisting of touch, visual and sound. These entry points were significant in their model of the composing process, but they indicated an area of uncertainty in which 'no data - verbal or otherwise' was present (Yunker and Smith, 1996, p.33). This explanation suggests that the research methods were unable to fully capture all aspects of the composing process, particularly those instances of silence and non-verbal interaction. It further highlights the need for more comprehensive research methods that can capture the pupils' compositional moments that include non-verbal and silent communication.

2.4.2 The Intersection of Sociocultural Learning and Multimodality in Music Composition

The influence of sociocultural views of learning has become increasingly apparent in the last twenty years and this is equally reflected in music education research (e.g. Gall and Breeze, 2008; Devaney, 2019). A sociocultural view of learning emphasises that meanings are negotiated, constructed, reconstructed, and transformed through individual's engagement in activities (Lave and Wenger, 1991; Rogoff, 2008). The nature of the task and its social context play a crucial role in shaping how learning evolves

through the sharing of knowledge among pupils, as suggested by Vygotsky (1978). However, it is important to note that in the context of co-construction and situated practice, verbal communication is often assumed to be the primary method through which learning occurs and influences action in the world (Lave and Wenger, 1991, p.22). This means that the learner will draw on available resources and tools from their social context to contribute to a joint achievement or aim, and the approach recognises that speech may initiate a person's social participation.

The study of composition in music education has shifted from a focus on the product to an emphasis on the activity of composing. Breeze (2011, p.389) asserted that the term *composition* should be known as *composing*, citing that UK examination boards were interested in the activity of composition rather than its product. According to Devaney et al. (2024a), several international music education studies similarly share the evolving perspective of moving away from viewing composition as a final product to seeing it as an ongoing activity or process. In practice however, this distinction may be influenced by teachers' pedagogical choices and efficacy, their personal (perhaps tacit) definitions of composing, the school's curriculum and their assessment practices.

Breeze's (2011) study adopted multimodality as a theoretical and methodological framework in which learning seemingly examined sociocultural characteristics of prior knowledge, prior experiences and linguistics. This meant that through pre-observation and post-observation interviews and the transcript's inclusion of the activity's conversations, Breeze (2011, p.397) was able to determine the participants' pre-existing musical ideas, styles, genres and conventions. Even though the study considered non-aural modes, the outcomes focused on the teacher's pedagogical framing and the classroom environment. The shift from focusing solely on the product to considering the entire computer-based compositional process is significant, suggesting a more comprehensive approach to developing pupils' musical abilities (Breeze, 2011).

Similarly, Kirkman (2011, p.111) likened learning to compose using computer-based technology to the practice of shaping a product over time, in which the students' progress could be ascertained as changes in compositional context, structures and the process of composing. This suggests that music teachers should focus on the holistic

development of pupils' compositional skills, considering modes of interaction and expression, which may better support their creative processes and technological integration in music education.

2.4.3 Multimodal View of Learning

Theoretical developments within the field of multimodal social semiotics revised its initial position of linguistics as the foundation to understanding learning (e.g. Hodge and Kress, 1988; Kress and van Leeuwen, 2001) to the notion of communication and learning as being unified and inseparable (Bezemer and Kress, 2016). This particular view of learning may hold similar assumptions to sociocultural theory in that teaching and learning are social practices but, importantly, adds that teaching and learning are also instances of communication (Kress, Bezemer, Diamantopoulou, Jewitt and Mavers, 2021, p.70). In this multimodal social semiotic view of learning, different signs of learning come together in complex ways to evidence the pupils' ongoing processes of meaning-making, communication and learning (Bezemer and Kress, 2016; Kress et al., 2021).

From this multimodal social semiotic perspective, it follows that learning can be explored through non-verbal communication and actions, not just language. Lim (2019) challenges the dominant assumptions of language being central in teaching and learning, and thereby how we communicate, and examines the learners' unspoken modes, known as embodied modes. This means that a learner's communication and meaning-making prioritises action rather than language, recognising that not all actions are the same or communicate the same meanings. Learning in multimodality is still similarly defined but adopts a theoretical position of unspoken modes. From this perspective, meaningful learning can be explored from the learner's actions and non-verbal communication.

More recently, there are emerging theoretical frameworks in music education research that include the new *materialist posthuman* direction in which Pitt (2023), examines the relationship between human (learner) and non-human (for example, the computer and the disembodied sound) focusing on early childhood music. The article follows on from earlier research of MacRae and Arculus (2020) who explored a *more-than-words pedagogy* to engage and understand childhood communication. Therefore, the

dominant discourses of talk in music education research are being challenged and the field is broadening to include music research focusing on non-verbal interactions.

2.5 Examining Computer-based Music Composition at Secondary School in the UK

There is a growing body of academic literature exploring the impact of computer-based technology on pupils' learning of classroom composition in secondary schools. A key area of research focuses on the role of technology and how pupils use it to support their learning (Cain, 2004; Wise, 2016; Devaney, Ziegenmeyer and Hughes, 2024). This section addresses these overlapping themes by briefly acknowledging teacher's pedagogical choices, then exploring how pupils interact with software (Gall and Breeze, 2005), other digital tools and computer equipment (Bauer, 2014) and the diverse ways in which pupils approach composing.

2.5.1 Teacher's Pedagogical Choices

Several scholars argue that the teacher's pedagogical choices significantly impact pupils' learning (Savage and Challis, 2001; Pitts and Kwami, 2002; Price and Savage, 2012; Devaney et al., 2024a). The potential challenges are linked to the limitations of individual teacher's expertise (Savage, 2010) and the England's National Music Curriculum, which prescribes traditional and historical ways of knowing, specifically what counts as musical learning (Price and Savage, 2012; Fautley, 2019, 2024; Ziegenmeyer and Devaney, 2024). In the UK, research on teaching music composition in schools ranges from 'highly prescriptive to open-ended,' suggesting that approaches to learning are somewhat inconsistent and often reliant on teacher's pedagogical choices (Pitts and Kwami, 2002, p.65). However, Bauer (2014), an American educator and scholar, asserts that American teachers are beginning to adopt the same technology, styles and approaches to composing as their students use outside of school. This perspective attunes with Green's (2001) popular music pedagogy, and King and Vickers (2007) examination of how elements of the popular music pedagogy can be used in technology-based compositional tasks.

Effective music education involves careful consideration of pedagogical choices including the use of computer-based technology in composition. Devaney, Ziegenmeyer and Hughes (2024, p.331), explore how the use of computer-based technology in classrooms changes how we compose, arguing that technology challenges traditional norms and beliefs about musical learning. This impact particularly depends on whether computer-based technology is seen as intrinsic or extrinsic to pupils' learning (Savage, 2007). Savage (2007) found that UK secondary school music teachers preferred the extrinsic approach, meaning that teachers chose to use computer-based technology to make learning more accessible rather than changing their practices. This particular example illustrates how teacher's pedagogical choices are likely to influence how pupils approach computer-based music composition. Therefore, it is somewhat necessary for the teacher to consider these factors and be open to adapt their practice to ensure that pupils are equipped with relevant skills.

Past studies have yielded some important insights into teachers' responsibilities, such as prior organisation of learner roles (e.g. Gall and Breeze, 2008; Breeze, 2011), developing appropriate tasks and providing ample compositional time (e.g. Gall and Breeze, 2008; Himonides, 2012). Furthermore, there is an emphasis on not over-relying on technology to compose or forfeiting traditional music skills like learning to play an instrument (Cain, 2004) and concerns about whether composing requires a foundation of music theory (Devaney, Evans, Fautley and Ziegenmeyer, 2024b). Several studies highlight the potential challenges associated with using computer-based technology for composition, such as a loss of creativity due to pre-set loops (Gall and Breeze, 2005, 2008; Breeze, 2011; Wise et al., 2011). Some pedagogical decisions become interconnected with the pupils' learning in which accessibility and availability of time are concerns. The following subsections outline these challenges, highlighting the overlap between teacher's pedagogical decisions and the presupposed role of software and computer-based technology in composing.

2.5.2 The Role of Software and Computer-based Technology in Composing

The use of computer-based technology, such as music software, can provide pupils with a range of tools and resources that facilitate composing and positively impact their

musical development. Gall and Breeze's (2005) study found that pupils used the software in musically and culturally relevant ways, enabling them to successfully create music. The benefits of the software programs like Cubasis and Cubase VST, along with the computer screen, included:

- enabling pupil collaboration and meaning-making during activities;
- allowing pupils to record, save and review their work;
- providing opportunities to explore instruments, sounds and patterns, such as a drum kit that was not readily available to use in the classroom context; and
- offering multiple options for editing, mixing and arranging.

However, an earlier study by Savage and Challis (2001) noted the consequences of the teacher's pedagogical framing. Their study found that a particular software program, which manipulated sound, was too complicated for the pupils to use and was subsequently changed. Given the limited timescale and the focus on composing rather than gaining technological skills, changing the software was deemed necessary to ensure successful learning. However, this change may have unknowingly influenced the pupils' motivation to experiment with complex learning materials and thus altering research outcomes.

The role of computer-based technology and its software remains a contemporary issue that can influence pupils' compositional decisions and/or offer new compositional possibilities (Devaney, Ziegenmeyer and Hughes, 2024). As an example, there is ongoing criticism surrounding the prioritisation of music theory at the expense of composition, and vice versa (Devaney et al., 2024b, p.331), and adopting a balanced approach may enhance the pupils' theoretical and practical aspects of learning. This point is highlighted through the Sibelius' software programs default settings, such as time and key signatures, which set expectations of pupils' knowing music theory, including notation. In contrast, software programs that integrate video and sound have the potential to structure the pupils' compositional approach while allowing them to focus more on creating music (Dammers, 2013; Devaney, Ziegenmeyer and Hughes, 2024). This balanced approach may better encourage pupils learning using diverse structures, tonalities or sound possibilities.

Existing research has focused on teacher's perspectives, noting that technology saved time or was quicker than traditional compositional methods and addressed inclusivity and access for lower-ability pupils (Savage, 2010; Devaney, 2019). Studies from UK secondary schools reported that 71.4 percent of pupils in Key Stages 4 and 5 used computer-based technology to compose for 60 to 100 percent of the available class time (Devaney, 2019). In contrast, Savage (2010) found that Key Stage 3 pupils had less access or time to use computer-based technology than those in Key Stages 4 and 5. These differences highlight hidden implications of school policies favouring and prioritising GCSE examinations (Devaney, 2019) rather than accounting for the learning and inclusivity of all secondary school pupils.

2.5.3 Research Evidencing Pupils' Approaches to Computer-based Music Composition

A considerable body of music education research has analysed pupils' compositional processes, leading to differing theorisations and models (e.g. Wallas, 1926; Swanwick and Tillman, 1986; Webster, 1988; Berkely, 2001; Green, 2001, 2008; Fautley, 2005) or compositional strategies (e.g. Folkestad, Lindström and Hargreaves, 1997). However, some of these models predate the Music National Curriculum in 1988 and stem from pupils' dialogues during observations of their compositional activities, often in different groupings (e.g. instrumental or gender-based). Remarkably, few studies have explored computer-based music composition at Key Stage 3, and even fewer have examined UK secondary school pupils' non-verbal communication by operationalising Kress' (2010) or Bezemer and Kress' (2016) multimodal social semiotic theory of communication and learning.

One key debate in music education studies is how pupils access and use computer-based technology to compose, often focusing on their compositional processes. For instance, Folkestad, Lindström and Hargreaves (1997) describe *horizontal* and *vertical* compositional strategies. Figure 2.2 shows two compositional strategies: *horizontal*, which focuses on composing instrumental parts for the whole composition (start to finish), track-by-track, and *vertical* where all tracks are constructed and moving forward simultaneously bar-by-bar. The findings suggest that the horizontal strategy involves

separate processes for composing and arranging, whereas the vertical strategy integrates composing, arranging and instrumentation. The pupil's actions - playing, listening, evaluating, or any combination of these adds another layer for consideration.

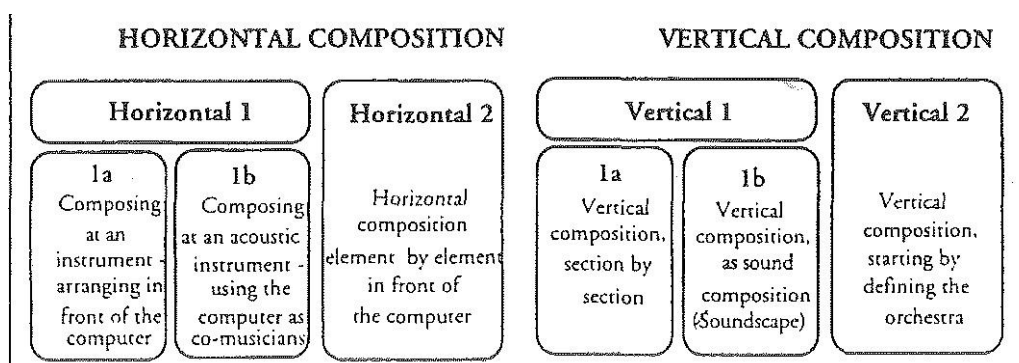


Figure 2.2: Compositional model (Folkestad, Lindström and Hargreaves, 1997, p.6)

Although understanding vertical and horizontal computer-based strategies provides valuable insights for teaching and assessing the composing process, it had little impact on the pupils' learning outcomes, which were consistently successful. Therefore, whilst the compositional strategy offers researchers and teachers a visual tool to identify and analyse how participants use computer-based technology to compose, it needs to be understood flexibly rather than in a categorical way.

Similar to Challis (2001) and Gall and Breeze (2005), Devaney, Ziegenmeyer and Hughes (2024) contend that pupils' approaches to computer-based composition are influenced by the software's visual and auditory aspects. This influence offers both positive and negative aspects to composing with computer-based technology. For example, plugins may allow pupils to create and manipulate sound, which provides additional tools to support composing (an intrinsic approach). While MIDI blocks and MIDI sounds are useful for creating music and instant playback, they may negatively shape the pupils' understanding of music. For instance, MIDI blocks may be seen and heard as discrete sound bites rather than continuous sound(s) and some MIDI sounds may affect how pupils' choose and represent instruments in their work (Devaney, 2019; Devaney, Ziegenmeyer and Hughes, 2024).

In a study of one pupil from a Year 10 GCSE music class of 28 pupils, Kirkman (2011) examined computer-based music composition, finding development occurred through five areas: exploration, time-away, recording, crafting and judgement. The pupil encountered three phases of learning, described by Kirkman (2011, p.9) as:

- phase one - using worksheets to work with computer-based technology;
- phase two - extension and new ideas using computer-based technology; and
- phase three - integrating an acoustic instrument with computer-based technology.

Notably, phase one limited the pupils' compositional freedom due to teacher-directed tasks. However, phases two and three showed a preferred way of learning which increased the pupil's ability to use prior musical skills, abilities and knowledge for deep learning outcomes. This learning was emphasised through improvising new ideas using computer-based technology and recording the pupil's saxophone playing with a microphone. Using various technologies, acoustic instruments and voice in a classroom-based context positively impacted pupils' learning and enhanced their interest, motivation and skills development (Savage and Challis, 2001). Computer-based technology provides benefits of visual and aural modes in which real-time sound, different computer-based programs with various software windows (or options) and interaction with others contribute to the overall compositional success.

A contrasting six-week study involving 41 Year 9 pupils at an independent secondary school for girls in London found that an integration of four activities supported teaching computer-based music composition (Minott, 2015). The teacher described the activities as (1) preparation, (2) exposition and demonstration, (3) technical, classroom management, monitoring computer usage and (4) allocation and learning support. Of the four activities, 87 percent of pupils reported *learning support* as the most useful, citing the teacher's affirmations or resolution of technical issues most frequently (Minott, 2015, p.26). Interestingly, the teacher's choices in tasks and support highlighted that pupils perceived these activities as having a positive impact on their compositional learning.

In summary, the integration of computer-based technology in music education offers substantial benefits for pupils' compositional work and learning, while also presenting some comparative limitations when contrasted with traditional methods. However, computer-based composition's effectiveness largely depends on strategic implementation, thoughtful pedagogical choices and supportive policies that provide equal opportunities for all pupils. This underscores the importance of a balanced approach (Devaney et al., 2024b; Devaney, Ziegenmeyer and Hughes, 2024). Studies show that pupils go through distinct phases when integrating technology into their music composition, from initial structured tasks to more independent and creative use of technology. This progression highlights the importance of allowing pupils to explore and integrate their prior musical skills with new technologies.

2.6 Relevant Research from a Multimodal Social Semiotic Perspective

This section, the first of four, considers literature that is representative of how the multimodal social semiotic theory has been operationalised within educational and school contexts. It focuses on studies that examines participants' learning and the effects of the availability of different modes as participants engage in classroom activities.

Research in multimodal social semiotics views communication as encompassing diverse modes beyond traditional classroom talk and written texts (Kress and van Leeuwen, 2001; Jewitt, 2008; Jewitt, Bezemer, Jones and Kress, 2009). As Jewitt, Kress, Ogborn and Tsatsarelis (2001, p.xii) state,

'Language is not absent from our discussion, but nor is it central. It is, as we have said, "there", but "there" among all other modes: foregrounded when it is, in the representational ensemble, and not foregrounded in our descriptions when it is not so in the data.'

This quote underscores that language is merely one among many modes of communication and should not always be the primary research focus. From a multimodal social semiotic perspective, this key text, based on a secondary school

science classroom in the UK, established a connection between the different modes and how these impacted on classroom learning (Jewitt et al., 2001). Learning was recognised as an ongoing process of sign-making through the interactions between teacher and pupils, using visual and linguistic modes to communicate their intentions. Although the study sought to identify the pupils' cognitive processes, it took the view that, 'learning is a process of selection, adaptation and transformation motivated by the interests of pupils and the context of learning' (Jewitt et al., 2001, p.5). This definition of multimodal learning continues to be reflected in later research, for example, Kress and Selander (2012) and Bezemer and Kress (2016).

Jewitt et al. (2001) identified the process of selection, adaptation and transformation as central to multimodal social semiotic theory of learning, which shares similarities with a sociocultural view of learning:

- the concept of ensemble of modes;
- the transformation of learning through the availability of classroom resources from within the classroom; and
- recognising the teacher's communication and/or influences outside school offer insights into the pupils' learning.

The term 'variation' to interpret learning by examining differences between the teacher's communication and the pupils' interests, as shown in the production of their texts (Jewitt et al., 2001). In music education, for example, this could be the difference between the intended learning outcomes specified on a lesson plan and the pupil's compositional product which may, or may not, attend to those specifications. A more useful analytical approach includes the examination of the pupils' transformations and transductions from their activities (Jewitt et al., 2001), as it focuses on the pupils' interests and their work rather than the teacher's communication.

Other studies, similarly, show transformations as 'semiotic work' that involves engagement and choice, for example changes within classroom resources and pupils' interactions. Transformations occur when these resources are chosen, adapted and combined to create new meanings (Mavers, 2009, pp.141-142) and through the actions

pupils choose to engage with in different tasks (Jewitt and Franks, 2001; Jewitt, 2008). Transduction, on the other hand, involves remaking meanings across modes, from one mode to another, such as from text to image. These interpretations are theoretically aligned with the current stance taken in social semiotics where all modes of communication and their available resources are attended to (Bezemer and Kress, 2016).

Several studies have shown that using technology in the classroom has broadened pupil's availability of modes, and their resources, emphasising how this supports their meaning-making (Jewitt, 2008; Jewitt et al., 2009; Mavers, 2009; Crescenzi et al., 2014; Ranker, 2014; Cowan, 2020). In order to understand classroom teaching and learning, Jewitt (2008, p.242) states that there is a need to, 'explore the ways in which representations in all modes feature in the classroom'. This particular notion is useful as it considers how pupils aptly choose and disseminate different resources through their interactions and integration of them during computer-based tasks.

Previous studies that have analysed semiotic practices in using social media (Poulsen and Kvåle, 2018) as well as media such as TV, radio, music and film (West, 2011; Burn, 2017; Mroziak 2017), found technology will structure how people communicate and interact. Poulsen and Kvåle (2018) further suggest that communication and interaction will be dependent on the availability of technology, and equally what that technology is. For example, if the software interface (e.g. GarageBand) is unknown to pupils this will limit their social practice during their computer-based compositional work.

Rostvall and West (2003, 2005) and West (2011) explored the importance of context and interaction in peripatetic music teaching, in Sweden, using an interdisciplinary framework. Their work offers an analytical approach that consists of three levels. However, the first level of their three-level analytical approach is the only level that uses aspects of social semiotic theory. The overall research aim was to add value to teaching and learning by recognising patterns of interaction in, and between, the different modes (Rostvall and West, 2003). Three modes were explored: music, gestures and spoken language (including examples of other verbal communication, i.e. grunts and singing). The researchers underpinning assumption suggested that no one mode

worked in isolation when their participants were actively engaged in the lesson. Instead, each of the three studies reported a complex representation of resources, of differing patterns, moving in and between the mode of spoken language, musical sound, and the mode of gesture. This was captured in the descriptive content of transcripts detailing the teachers' and pupils' interactions.

Drawing further on the work of Rostvall and West (2005), two points related to transcription and selection criteria of episodes are of particular interest. The transcription process shows how data and theory were transposed from video to chart, making visible the available resources for communication. The interactions were framed using linguistic conventions (i.e. pauses, patterns of rhythm and intonation or gesture) in what Rostvall and West (2005) called a 'message unit'. The activities were then mapped onto a chart (e.g. Excel spreadsheet) with each unit beginning a new line and included the following information: time code, teacher's and pupil's musical activity, teacher's and pupil's talk and the teacher and pupil's gestures (Rostvall and West, 2005, p.6). This example recognises patterns of interactions in and between the different modes and substantiates the level of detail required to make appropriate and useful interpretations of the data.

2.6.1 Summary

Multimodal social semiotics provides the theoretical means to examine modes and meaning-making in specific contexts. The approach can incorporate the exploration of technology and how these additional resources potentially shape the pupils meaning-making and learning. Transductions and transformations of resources involve a multiplicity of modes of communication, they are complex, ongoing and simultaneous processes of interaction, sign making and interpretation to create new meanings. Learning is recognised as a continuous process of sign-making (Jewitt et al., 2001; Kress and Selander, 2012; Bezemer and Kress, 2016). The literature in this section has extended the ways of conceptualising learning in an educational context by utilising some of the theoretical principles of multimodal social semiotics, e.g. modes and transformation of resources.

2.7 Music Research through a Multimodal Interactional Analysis Lens

Section 2.7, the second of four sections, introduces multimodal interactional analysis and examines a small representative sample of classroom-based music research. According to Kress and van Leeuwen (2001, p.114) multimodal interaction (or action) can be viewed as semiotic, in so much as, when we communicate with someone, ‘we *interact*’. The purpose of interactional analysis is to explore social actions and interactions in communication and identifies language as a dominant mode of communication (Jewitt et al., 2016). Multimodal interactional analysis offers insights into how people use embodied modes (e.g. gaze and gesture) and disembodied modes (e.g. layout and proxemics) to create meaning (Jewitt et al., 2016). These theoretical concepts offer relevancy to Key Stage 3 music lessons as pupils typically undertake computer-based composition in pairs. Another important feature is the use of video materials which are then mapped to show the participants different modes of communication.

Multimodal interactional analysis has been conducted in a variety of educational contexts, for example medical workplace learning (Heath, Hindmarsh and Luff, 2010), museum visits (Diamantopoulou and Christidou, 2019), music education (Tomlinson, 2012, 2014; Huovinen and Rautanen, 2020), and learning in graduate Design classroom (Moura, 2006). An underlying principle of this approach focuses on a person’s identity and interactions which are taken to form a part of their wider social context. A number of studies report higher-level actions showing complete communications with openings and closings, such as saying hello and goodbye, and lower-level actions, referring to intonation or a breath (Norris, 2004; Moura, 2006; Jewitt et al., 2016; Geenen and Pirini, 2019). For example, verbal communication may be supported with hand gestures or a glance which likely hold differing hierarchical positions within lower-level actions.

There is a small body of multimodal interactional analysis and classroom-based music research (Tomlinson, 2012, 2014; Huovinen and Rautanen, 2020). These studies provide contrasting transcript designs and differences in the details of the pupils’ higher-level and lower-level interactions. Of particular interest is how the embodied and

disembodied modes of the pupils' interactions are depicted and whether the transcript addresses how learning occurred and what modes were used.

Tomlinson's (2012) study, of two early years classroom settings of 5 year-old pupils in Australia, reports using a multimodal social semiotic framework although the transcript in Figure 2.3 arguably also draws on multimodal interactional analysis. It provides a linear representation of the pupils playing the music which identifies and records the modes that accompany their actions and interactions. The modes depicted in the transcription (i.e. voice and gaze) co-exist with musical notation and a hierarchical format records the pupils' movements according to the researcher's observations, such as: music rhythm phrasing, movement of head, shoulders and fingers as well as whole body movement. In the visual representation, the music score moves from left to right, so all rows in a column occur in succession.

[image has been redacted from the digital version of the thesis for copyright reasons]

Figure 2.3: Partial transcript of a music score showing pupils music to speech interaction (Tomlinson, 2014, n.p.)

In this transcript (Fig 2.3), the coloured modal blocks and temporal succession foreground the complexities behind social interaction. Each mode is assigned a colour, for example, yellow signifies the gaze mode. When the specific modes are observed, the coloured block is reused to depict length of time and placed according to its hierarchical *value*. This transcript goes beyond an attempt to document and represent what took place.

Recent research compares the compositional processes of primary school pupils using different resources through interactional analysis. Huovinen and Rautanen (2020) examined 40 pupils aged 10-12 in Finland, offering a different perspective on applying interactional analysis by comparing compositional processes of pupil groupings using instruments versus iPads with GarageBand software. The researchers pre-planned a soundscape task to compose music for a space film. Video was used to capture the pupils' interactions, and the analysis provided a written text or narrative focused on 'musical and bodily gestures, changes in action patterns, and linguistic utterances made by the participants' (Huovinen and Rautanen, 2020, p.99).

Of particular interest is the way in which the narrative provides a transcript which then acts as a tool to determine the group's compositional activity. Each group's transcript was subsequently coded by categorising the interpreted types of music actions which Huovinen and Rautanen (2020, p.99) described as:

- *presentation* - introducing a musical idea;
- *illustration* - demonstrating an idea through musical sound;
- *conformity* - implicit agreement; and
- *linguistic actions* - such as suggestion, appraisal, acceptance, advice and questioning.

Figure 2.4 shows a written transcript example of Group 1's compositional activity. The episode of music action was categorised as *presentation* (Huovinen and Rautanen, 2020, p.100).

Group 1. [2:45] A and B continue their sonic experiments, inventing a melodic theme. A says: "This is good!" B responds: "Yeah, frightening!" A continues playing the melody. B takes the rain stick, starting to tilt it, making a rustling sound. C and D nod approvingly to the new sound. A asks: "What kind of tempo should we take?" A claps her hands in tempo. [3:10]

Figure 2.4: Transcript of music composition (Huovinen and Rautanen, 2020, p.100)

A key shortcoming is that Huovinen and Rautanen (2020) have not integrated the principles of interactional analysis, namely, how modes of communication or their resources are enacted hierarchically. The analysis that offers little clarity regarding the significance of the pupils' non-verbal communication or how this specific example constitutes the compositional category of presentation. Nevertheless, this approach does examine the pupils' actions, and it is evident that collaboration was formed through pairs of pupils, AB and CD. It is interesting to note that the extract opens with action rather than speech, suggesting that non-verbal communication prompted examination of this excerpt. Even though the transcript and analysis provide a partial representation, the utterances resembled lower-level mediated actions (e.g. 'This is good!') and when seen in connection with other utterances they lead to a concrete experience (Norris, 2004).

2.7.1 Summary

The most prominent assumption of multimodal interactional analysis was evidenced in the transcripts in which speech, and gestures of speech, were significant in identifying social action (Tomlinson, 2014; Huovinen and Rautanen, 2020). These social actions were further evidenced through the pupils' embodied modes (i.e. gaze, whole body movement and nodding of the head) which could show the cumulative effect of how non-verbal modes communicate the pupils' musical intentions.

Tomlinson (2014) added music notation and the disembodied mode of proxemics to show the hierarchical positioning of actions as described in Norris's work (2004) whereas Huovinen and Rautanen's (2020) transcript was less explicit in detailing the embodied modes. In both studies, interaction unfolded in a temporal frame with analysts examining interaction, artefacts and texts from within the studies' context. Both transcripts offer insights into how a small number of participants non-verbal embodied modes could be represented over the duration of an activity. However, Tomlinson's (2014) transcript design seems to offer more scope in combining non-verbal modes of communication to enable analysis.

2.8 Educational Research from a Multimodal Discourse Analysis Perspective

Section 2.8 introduces the third perspective of multimodal discourse analysis addressing the key principles and considers the relevancy of two pedagogical issues concerning digital literacy skills and non-digital resources. Section 2.8.1 outlines relevant research literature from the perspectives of music and music education.

Multimodal discourse analysis has been founded upon the analysis of verbal language, writing and speech (Gérman, 2021). Existing research shows that Halliday's (1978) metafunctions (ideational, interpersonal and textual), particularly systemic functional linguistics (SFL), underpin this discipline (Jewitt et al., 2016; O'Halloran, Tan and Wignell, 2016). Halliday's metafunctions are also associated with social semiotics and it is important to note that, within multimodal discourse analysis, these metafunctions are appropriated differently. Multimodal discourse analysis differs in that research is theoretically informed by systemic functional theory as an approach to analyse language. This means that systemic functional linguistics often concerns the systematic organisation of semiotic resources as tools for creating meaning in society (Jewitt et al., 2016, p.31).

Recent studies include proxemics in the music classroom (Norris, 2004; Breeze, 2008), literacy skills in Early Years computer-based music composition (McDowall, 2009), proxemics through mapping the teacher's positioning and movement in a classroom (Lim, O'Halloran and Podlasov, 2012), mathematics (O'Halloran, 2015) and teacher's gestures (Lim, 2019), whilst worthy of consideration, are beyond the scope of this literature review. Unsworth and Mills (2020) and Djonov, Tseng and Lim (2021) offer valuable and non-musical insights concerning a teacher's pedagogy, such as pupils' digital literacy skills and activities combining the use of digital and non-digital artefacts. Both studies identified limitations with the pupils' ability to fully understand the software as a semiotic resource, and to a greater extent when the software was new to them. They argued that prior instruction (e.g. YouTube tutorials) was necessary to enable pupils to aptly draw upon resources within the activity. Additionally, the studies

highlighted how different modes of communication supported meaning-making across the digital and non-digital divide. This means that a child was able to connect and distinguish across and between different media, i.e. an animated narration (moving image), compared to a mother reading (words and speech).

2.8.1 Multimodal Discourse Analysis in Music Education Research

Theo van Leeuwen's (1999) work theorises how speech, music and sounds (or other noises) become integrated and shape multimodal discourse analysis in music through six interwoven categories of sound perspective, sound time and rhythm, interaction of *voices* melody, voice quality and timbre, and modality. Further music-based studies aligning with the theoretical framework of multimodal discourse analysis include linguistic conventions in musical terms (Machin, 2010; Berry and Wyse, 2011; McKerrell and Way, 2017), human speech interactions with computer-game music (Machin and van Leeuwen, 2016) and semiotic technology (Djonov and van Leeuwen, 2018). Of the available research, in Europe, Australia and the UK, it is important to understand how semiotics can be understood in musical terms and the scholars argue that music contributes to semiotics as a language (van Leeuwen, 1999; Machin, 2010; Martin, 2014; McKerrell and Way, 2017; Carugno, 2018). Although these studies use discourse analysis to discuss music, several reports on data obtained beyond the context of music education and these are, therefore, not discussed in this subsection.

Martin (2014, pp.186-189) illustrates concerns in which musical notation is likened to mathematical symbolism (O'Halloran, 2007; 2015), such as time signatures (4/4) or chordal patterns (C,E,G) and argues that music notation is a language-based semiotic resource. Three separate issues are raised by the research. The first draws on Halliday's (1978) theoretical approach to semiotics where the written musical notes are portrayed as the signifier and the sound attached to the note corresponds as the signified. The second issue suggests that musical notation is viewed as a semiotic resource (Martin, 2014). Due to specific attributes referred to as modes (e.g. icon, image, colour, shapes) that make, or enable learners to draw, an individual musical note means that musical notation is more than a language-based semiotic resource (Berry and Wyse, 2011). The third considers the computer-based software, e.g. GarageBand or Dance eJay's FX

Studio, which provides further symbolism in the form of sound waves on a track or musical notes on the stave. Gall and Breeze (2008) suggested that computer-based notation and FX software further shaped the pupils' representations and meaning-making potentials differently than by using traditional notation. In some respects, the principles share similarities with visual grammar (Kress and van Leeuwen, 1996), multiliteracies (Unsworth, 2001, 2007) or digital literacy (Unsworth and Mills, 2020; Djonov et al., 2021), whereby both the material and social reality of these representations are necessary to enable meaning-making.

2.8.2 Summary

Multimodal discourse analysis (MDA) is not an appropriate approach for researching non-verbal communication, as language often takes precedence over other modes (van Leeuwen, 2012). This emphasis suggests a possible linguistic bias that can limit our understanding of how meaning is constructed. Other key challenges include limited research choices and using existing theoretical frameworks. For instance, MDA needs to balance between examining the process (how communication unfolds) and the product (the resulting texts or artefacts), e.g. exploring whether written music notation adheres to music composition rules (Martin, 2014). Existing frameworks (e.g. systemic functional linguistics) need careful consideration as they may not fully capture the richness of meaning-making across diverse modes. Using adaptable approaches would account for the complexity of examining non-verbal communication.

2.9 Music Research from a Multimodal Conversational Analysis Perspective

Section 2.9 is the final of the four interlinked sections that explores different multimodal approaches within the domain of multimodality.

The existing literature, in the field of conversational analysis, examines a range of social situations in the medical field (Mondada, 2011; Kress et al., 2021), pre-school play (Goodwin, 2000; Peterson, Ranjendram and Eisazadeh, 2019), action in interaction

(Enfield and Sidnell, 2017), intersecting actions (Raymond and Lerner, 2014) and in the use of video recordings (Goodwin, 2000; Heath et al., 2010). Multimodal conversational analysis is based on sequentiality where action within its socially and culturally situated contexts is examined one action at a time (Jewitt et al., 2016). A definition of multimodal conversational analysis, expanded to include social interaction within language, gesture, gaze and the body, specifically focusing on non-verbal cues (Mondada, 2014). An altogether different interpretation was offered by Haviland (2011) who perceived music itself - or the manifestation of sound - to act as a conversation. This last perspective accounts for turn-taking, gaps and pauses to be visible in the musician's performance.

2.9.1 Multimodal Conversational Analysis in Music Education

Few studies in the field of multimodal conversational analysis have sought to examine music education (Haviland, 2011). However, conversational analysis was previously referred to as a means to interpret silence through the gaps, pauses and lapses in speech (Section 2.3.2; Maroni, 2011; Mondada, 2019). The remainder of this section shows how conversational analysis further underpins research in the field of music education.

Haviland's (2011) video-research of an undergraduate string quartet masterclass focused on the theoretical notion of coordination of action and space. The study's purpose was to examine how four string instrumentalists' interactions were coordinated to create one joint performance as they played a piece of music and offers insights to how a researcher might examine movement and actions. The study was somewhat different to others in its field as it firstly focused on four participants opposed to two (Goodwin, 2000; Mondada, 2011; Raymond and Lerner, 2014; Peterson et al., 2019) and secondly, treated the music as a language. Movement of the instrumentalists is different to that of say a surgeon (Heath et al., 2010; Mondada, 2011) and could quite conceivably include non-verbal communication such as arousal and/or pleasure (Mehrabian, 1981). These movements, or behaviours, may be quite natural responses in competent musicians, such as upper body movements when playing the music. It raises questions about their non-verbal communications, perhaps in how these upper body movements support the quartet's timekeeping or an individual's musicality.

Haviland's work is similar to some studies in music education (e.g. Dillon, 2003; Gall and Breeze, 2005; Hewitt, 2008; Martin, 2014), in that visual and auditory cues become important in deciphering non-verbal communications. In music performance, the space (or layout) of a string quartet would traditionally adhere to a seating arrangement in which the space between each player holds a significant value for non-verbal and visual cues. Haviland (2011) argues that visual representation alone may not be sufficient to determine the coordination of action and suggests that sound plays an equally important role in this coordination, for instance, whether the music sounds harmonised, synchronised or rhythmically together. Therefore, the value of this analytical approach is that it supports the identification of how non-verbal communication emerges through the mutual elaboration of semiotic resources (Goodwin, 2000) to show the connection between actions and compositional patterns.

2.9.2 Summary

Multimodal conversational analysis closely follows unfolding events between a small number of participants which often uses video recording as the primary data source. A theoretical implication of conversation analysis means that research is highly data-driven. There is no reason to assume that the chosen events were selected according to any specific criterion other than the customary practice of selecting phenomena of interest for analytical purposes. This approach opens new avenues for research in music education and performance. It highlights the importance of non-verbal communication, coordination of action and space, and the role of sound. These insights have the potential to enhance understanding of non-verbal communication in music education.

2.10 Music Education Research that Draws on Multimodality

The chapter's penultimate section focuses on research in music education that combines multimodality with other theoretical frameworks, such as sociocultural theory (Gall and Breeze, 2005, 2008; Breeze, 2008, 2011; Pramling and Wallerstedt, 2009), ecology (Schmid, 2015; Bremmer, Hermans and Lamers, 2021) and psychological perspectives with embodied music cognition (Nijs and Bremmer, 2019). These studies are representative of music education and classroom practice across all phases from

preschool (age 4) to secondary school (ages 14-16), including research that is inclusive of pupils with multiple disabilities (Bremmer et al., 2021). In what follows, the developments of contrasting theoretical approaches and emerging multimodal concepts are traced.

2.10.1 Studies using Sociocultural Theory and Multimodality

Research combining multimodality with sociocultural theory often uses the term 'mediation' or 'mediated action' to describe how pupils learn as they engage in an activity. The concept of mediated action, often associated with Vygotsky's work (1978), describes how people interact and how objects and tools facilitate communication and meaning-making (Wertsch, 1991). For instance, Pramling and Wallerstedt (2009) explored the role of mediation in listening to music, demonstrating that pupils utilise additional semiotic resources, such as gestures, when verbal expression is insufficient or unattainable. In contrast, Gall and Breeze (2005, 2008) and Breeze (2008, 2011) examined the use of computer technology, MIDI devices, and music software to explore the interactions between the pupils' action and tools. Therefore, the works of Gall and Breeze (2005), Breeze (2008, 2011), and Pramling and Wallerstedt (2009) illustrate how mediated action can complement multimodal studies in music education. They also recognise the necessity of integrating multiple modes beyond spoken and written language (Kress and van Leeuwen, 2001; Kress, 2010; Jewitt, 2011a).

Gall and Breeze's (2005; Section 2.5) study reported findings on the theme of teaching and learning music in three UK schools, one primary (aged 10-11) and two secondary (aged 12-14). Focusing on the analysis of the pupils' classroom interactions and interview transcripts for school 3 (pupils aged 13-14), pupils used Cubase VST software (Virtual Studio Technology) to arrange musical phrases for an adventure film. The visual layout of the programme, particularly how the coloured blocks facilitate the placement of different sounds, was considered. The transcript (Gall and Breeze, 2005, pp.427-428) demonstrated the integration of verbal and non-verbal modes, such as listening to music and gesturing towards the computer screen, thereby illustrating how visual and auditory stimuli can contribute to an understanding of non-verbal communication in the learning process. However, the study does not fully account for the non-verbal communication

or the learning that transpires and relies on sociocultural theory rather than earlier iterations of learning from a multimodal social semiotic perspective. This gap highlights the need for a more comprehensive approach that uses a multimodal social semiotic perspective to fully understand the role of non-verbal communication in learning.

Other sociocultural studies drew on multimodal concepts such as transduction (Pramling and Wallerstedt, 2009) and design and transformation (Breeze, 2008, 2011) that aimed to extend the researcher's interpretations of their participants' learning by demonstrating change.

The key theoretical argument in Breeze's (2008) study is the relationship between *design and transformation* in identifying pupils' existing musical ideas and their origins. Design and transformation were analysed as individual entities. The concept of *design* examined pupils' compositional processes and accounted for influences found in the learning environment (i.e. pedagogical framing or existing musical experiences of pupils). In contrast, *production* was defined by the compositional product being facilitated or mediated by computer technology, i.e. focusing on the role of technology in composition. There was a notable unification between the multimodal concept of discourse, design, production and distribution (Kress and van Leeuwen, 2001), where transformation resided in the 'design' of the activities, not to be confused with pupils' design for learning (Kress and Selander, 2012).

Breeze's (2011) article maintained its focus on the UK secondary school participants, as detailed in his 2008 doctoral research. The concept of learning design was examined and defined as 'the ways in which teachers orchestrate the various aspects of the learning environment to enable effective pupil learning' (Breeze, 2011, p.391). The pupils composed a piece of music that represented Mussorgsky's (1874) *Pictures at an Exhibition* using computer-based technology with the programme Cubasis over five weeks. Therefore, and from a teacher's perspective, the study highlights the importance of an effective learning design, thus creating an environment that fosters pupil engagement and success.

The analytical framework uses multimodal social semiotics following Halliday's (1978) theory, in which Breeze (2011, p.392) identified 'the computer as the *aural* mode of the music; the *visual* mode of the screen and *gestural* mode of the keyboard performance and inter-group collaboration'. Two additional categorisations emphasised the spatial mode of classroom space, furniture and equipment and the teachers' and pupils' modes of communication also became available for analysis. Breeze's (2011) interpretation of *available resources*, for instance, riffs, chords or known musical phrases, was then attributed to the concept of *design and transformation*, which relies on an earlier iteration of multimodality (Kress and van Leeuwen, 2001). One question that arises, is whether the micro-analysis considered more than the pupils' MIDI keyboard playing as examples of transformations.

The findings of Breeze's (2011, pp.396-397) article presented four themes: the planning of lesson activities, the physical layout of the equipment and furniture, the roles undertaken by the pupils and the sequencer templates. Each contributes to one of three key outcomes. Two outcomes are of particular interest. The first regards the multimodal concept of *pupil interest and motivation* (Bezemer and Kress, 2016), in which lesson planning requires a balanced approach to tasks ensuring aspects of constraint, encouragement and authenticity to the pupils' out-of-school musical experiences. The second outcome considers the pupils' computer-based compositional materials, which are rarely crystallised as an outcome of experimentation, reviewing, editing and then disregarding unwanted materials. Breeze (2011, p.401) suggests that as practitioners, we could reconsider the assessment process 'to balance it more towards the computer-based compositional process rather than product'.

2.10.2 Two Studies using a Multimodal and Ecological Approach

Two studies that draw on the theoretical perspectives of multimodality and an ecological approach create a framework to 'foster natural music experiences' (Schmid, 2015, p.109; Bremmer et al., 2021). Firstly, Schmid (2015) presented a theoretical model by mapping the multimodal dimensions of children's musical experiences, followed by the work of Bremmer et al., (2021), who actioned the model in their study. Interestingly, Schmid's (2015) open framework, as shown in Fig 2.5 (p.66) incorporated environmental

factors that influence pupils' experiences (i.e. emotions and cognition) and cited Dewey's notion of transformative quality of experience, meaning the pupils learnt through a hands-on approach. The open framework delineates how different musical activities reside in four dimensions: embodiment, narrativity, sociality and materiality (Schmid, 2015). Multimodality is embedded in the model as modes which include the way gesture, body movement, acoustics, visual and haptics are drawn together to enable the pupils to be musically creative. Furthermore, there was an apparent emphasis on the pupils' preferences becoming the inspiration for the music produced, whether this was embodied through movement or an instrumental choice. This point links to Kress's (2010) theoretical notion of 'interest' where it assumes a holistic sense of the pupils' activities.

[image has been redacted from the digital version of the thesis for copyright reasons]

Figure 2.5: Dimensions of children's music experience - open framework
(Schmid, 2015, p.109)

A more recent study based on Schmid's (2015) open framework for children's musical experiences examined how teachers applied a multimodal approach to the teaching of pupils with severe or multiple disabilities in special education (Bremmer et al., 2021).

The main arguments considered how pupils may be challenged to understand the meaning of music, especially when music was often invisible. This framework provided a teacher's pedagogical planning tool to support them. Their study found that when teachers prompted music activities using the 'Beleven in Muziek'² (BiM) method (specially developed activities for people with severe or multiple disabilities), the dimension of embodiment became significant as an ensemble of sensory modes that enabled a sense of musical understanding. The study suggests that considering multiple sensory modes in music education can enhance musical understanding and engagement, particularly for pupils with severe or multiple disabilities.

2.10.3 A Study using a Kinaesthetic and Multimodal Perspective

Lastly, Nijs and Bremmer's (2019) study adopted both a kinaesthetic and multimodal perspective to understand how people make sense of, and learn, music. Their study examined the principle of multimodal embodied music cognition arguing that music was inherently multimodal and that meaning could materialise when pupils connect music to movement in an embodied way. Theoretically, they argued that musical meanings emerge from the principles underpinning the transformation of sound to movement which may then include emotion. Transformation is viewed in a slightly different light to that of Breeze (2008) or transduction (Pramling and Wallerstedt, 2009) but still involves locating the change that occurs across the modes. Nijs and Bremmer (2019) referred to this transformation as the process of enactment.

2.10.4 Summary

Past studies in music education have yielded some important insights into how they adopt different aspects of multimodal theory, even though their research is not solely framed by multimodality. There are two consistencies across the research:

- learning in music education often draws on sociocultural theories of social interaction and mediation; and

² Translated as 'experiencing in music' (Bremmer et al., 2021, p.260).

- multimodal principles of transformation, transduction (or the process of enactment) identify the salience of capturing data at the point of change.

2.11 Chapter Conclusion

There is no single definition for learning in formal educational contexts. In music education, there is an entanglement of diverse theoretical perspectives with competing theories of learning, differing pedagogies and concepts. These elements shape how learning and classroom composition may transpire (Fautley and Savage, 2008, 2013; Price and Savage, 2012; Cooke et al., 2016). However, it is important to recognise the assumptions and challenges these different theoretical perspectives pose. As researchers and teachers, we each have preferred theories for explaining how pupils learn music (Fautley and Savage, 2013; Cooke et al., 2016; Philpott and Wright, 2019).

Research on music education and the impact of non-verbal communication has mostly been from constructivist and sociocultural perspectives. This research often involves comparing actual learning outcomes with teachers' expectations or the content of pupils' dialogue (e.g. Gall and Breeze, 2008; Hewitt, 2008; Mellor, 2008; Breeze, 2011; Devaney, 2019). To date, few studies have exclusively examined computer-based composing in the context of an English secondary school at Key Stage 3 (ages 11-14), such as Breeze (2011) and Minott (2015), and even fewer studies have considered a multimodal social semiotic theory of communication to explore learning in this context.

Kress et al. (2021) noted that using technology has changed the way in which semiotics becomes visible in classrooms. These recent changes raise new questions about what is to be learned and how it is to be learned (Kress et al., 2021, pp.96-97). Learning in a music classroom involves the transformative engagement of pupils' interests, choices and selection of modes and resources of modes as they communicate across different social boundaries, musical abilities and skills. Multimodality offers a rich framework for providing in-depth analytical opportunities to locate interaction, communication and learning (e.g. Rostvall and West, 2005; Bezemer and Kress, 2016; Mondada, 2019; Lim, 2019), including embodied interactions such as facial expressions or gaze. Applying concepts from Kress' (2010) and Bezemer and Kress' (2016) multimodal social semiotic

theory of communication can deepen our understanding of non-verbal communication by questioning the signs of learning pupils show.

Understanding the perspective of multimodal social semiotics could help music teachers and researchers recognise that learning is not solely about language but involves multiple modes of communication (Bezemer and Kress, 2016; Kress et al., 2021). By paying attention to non-verbal cues and actions in the classroom, valuable insights into pupils' learning could assist and tailor teaching methods to support all learners more effectively. Equally, recognising emerging theoretical frameworks, such as multimodal social semiotics (Pramling and Wellerstedt, 2009; Breeze, 2011; Bezemer and Kress, 2016) and the new materialist posthuman direction (Pitt, 2023), encourages teachers and researchers to incorporate new approaches that consider the interactions between humans and technology. These approaches may enrich the pupils' learning experiences and support teaching practices to keep pace with technological advancements.

The literature raises questions about how using computer-based technology changes the visibility and role of semiotics in the music classroom and what insights might become valuable from applying multimodal social semiotic theory to non-verbal communication in a music classroom context. Although research on non-verbal communication and multimodal approaches is extensive, little research has operationalised and applied selected concepts of multimodal social semiotic theory to computer-based music composition at Key Stage 3 in a UK secondary school. By addressing this gap, researchers and music teachers may gain an in-depth understanding of the pupils' non-verbal communication as they demonstrate their signs of learning and designs for learning in computer-based music composition. The outcome may lead to enhanced teaching strategies and improved pupil engagement.

Therefore, this literature review raises some unresolved questions, such as:

What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?

and sub questions:

- a) What is 'silence' significant of?
- b) What kind of semiotic work happens during instances of non-verbal communication?
- c) How do the modes involved in this non-verbal communication evidence learning?

These questions allow for a micro-analysis of specific instances of non-verbal communication, such as silence, which can reveal subtle aspects of the pupils' signs of learning that broader questions might overlook. The questions provide a targeted area for examination enabling the research to be in-depth and focused. It is assumed that these questions will help understand the significance of silence and semiotic work during non-verbal communication, supporting collaboration and helping teachers respond to pupils' needs.

3.0 Chapter Three: Multimodal Social Semiotic Theoretical Framework

3.1 Introduction

The chapter draws together the theoretical resources from multimodal communication that are apt for the study of the pupils' embodied interactions with each other (e.g. facial expressions or gaze), music technology and its equipment. These interactions will be examined in what is referred to as instances of non-verbal communication when the pupil's mode of speech is absent. I am bringing together concepts from Kress' (2010) and Bezemer and Kress' (2016) multimodal social semiotic theory of communication. The chapter consists of six sections. This first section provides an introduction. Section 3.2 sets out the historical and theoretical foundations for social semiotics which is this study's chosen framework. The next three sections detail the concepts which form the analytical and interpretative tools my study will use. These include 'modes, and their resources' (Section 3.3), design and design for learning (Section 3.4) and the principles of recontextualization (Section 3.5). Section 3.6 summarises the chapter.

3.2 Multimodal Social Semiotic Theory of Communication

There is a strong legacy of linguistics in multimodality with the work of Hodge and Kress (1988) and Kress and van Leeuwen (2001) shaping multimodal social semiotics in such a way that we can account for communication beyond language. The thesis operationalises different multimodal social semiotic concepts from theory in which Kress's (2010) work is associated and applies them to two pupils' computer-based compositional activities. Using multimodal social semiotic theory is the most apt theory to examine the pupils' non-verbal modes during tasks that do not involve communication through speech.

Kress and van Leeuwen (2001, p.20) define communication as 'a process in which a semiotic product or event is both articulated or produced and interpreted or used'. They acknowledge that speech and writing has been foregrounded in research more than other modes of communication but theorise that the availability of multimodal

resources within a given context can be used to create meanings. Meanings are established from every sign made and every mode used for communication (Kress, 2010). This means that in the context of a UK secondary school music classroom, pupils' practices of computer-based composition and their agentive use of semiotic resources will enable their meaning-making to be represented. Therefore, examining two pupils' instances of non-verbal communication ('silence') is a specific and unique perspective to take.

There are three key multimodal assumptions that underpin this study's theoretical and analytical framework. The first, '*assumes representation and communication*' that combines modes beyond the spoken and written language used to contribute to our meaning-making (Kress and van Leeuwen, 2001; Kress, 2010; MODE, 2012, n.p.). Next, meaning-making is recognised as being socially and culturally constructed and always enacted within a specific context, or community, through the availability of semiotic resources (Kress, 2010; Jewitt, 2011). Lastly, the theory expects participants to engage in a community and/or social activity (Kress and van Leeuwen, 2001). Their point, pertaining to social activity and engagement, further contributes to a participant's overall meaning-making, in which different modes are enacted (Kress and van Leeuwen, 2001).

Existing research recognises the historical foundations of social semiotics and recent studies have developed beyond a focus on language to attend to a broader understanding of communication. Halliday's (1978) work furthers Saussure's (1974) traditional semiotics, known as 'sign systems in language', and provides the concept of 'systemic functional language' which relies heavily on language as social semiotics (Jewitt et al., 2016). Contrary to traditional semiotics, Hodge and Kress (1988) explored how social semiotics accounted for the context specificity of how people 'design' and interpret texts as society changes. As such, a central concept in social semiotics is that of 'sign' which is a conjunction of form and meaning, a signifier and a signified (Kress, 2010).

More recent research argues the importance of examining non-verbal communication in which Lim (2019, p.83) states there is, 'a certain inadequacy of classroom research

which involves only language'. Whilst Lim's statement supports my methodological decisions, it further shows the importance of examining non-verbal communication. Using and applying specific concepts of multimodal social semiotic theory is useful and apt in my study as I am looking for the significance of non-verbal multimodal interactions of pupils. Multimodal social semiotic theory enables me to ask questions, e.g. What is this instance of communication significant of? alongside exploring signs of learning that emerge in these interactions.

3.3 Modes and the Resources of Modes

The concept of '*modes*', and the '*resources of modes*', are vital in multimodal social semiotic theory. The purpose of mode allows exploration into the 'means and processes of meaning-making' (Kress, 2010; Bezemer and Kress, 2016, p.7). Resources of modes are specific features in relation to its corresponding mode, for example, directionality of gaze, and each resource of mode will signify something different (Kress, 2010). The work of van Leeuwen (1999) expanded the resource of mode within multimodal music research to include linguistic features, such as pitch, volume, intonation and rhythm. As stated, (see Section 2.6.2) these features are consistent with multimodal discourse analysis music research (Machin and van Leeuwen, 2016; McKerrell and Way, 2017) and linguistic conventions of composition are beyond the focus of my study. Within the music classroom, and computer-based compositional activities pupils will use complex configurations of modes to mean something in particular to them, and their task. For example, sitting upright and moving closer to the desk, with a prolonged gaze may signal the pupils enthusiasm and attention.

Research has established that in using classroom technology, more modes and their resources will be available for communication, such as the inclusion of media and moving image (Jewitt, 2008; Jewitt et al., 2009; Crescenzi et al., 2014). The additional modes further augment the complexities in considering how technology may influence the pupil's communication and representation. Modes are always recognised as being socially and culturally shaped suggesting that the social aspects of meaning-making, for example, engagement, agency and ways of learning can become visible (Kress, 2011, p.54; Bezemer and Kress, 2016; Jewitt et al., 2016; Cowan, 2020). Multimodality

interprets engagement in social activity (Kress and van Leeuwen, 2001) as something that can be recognised as both interaction and an integration of semiotic modes (Poulsen, 2015, n.p.).

Within this study's context, multimodal social semiotic theory attends to a multiplicity of modes: speech, action, computer-generated sound, gaze, gesture, facial expression and body movement. The theory recognises that each mode makes available different resources, each with possibilities and limitations from which meaning-making can be examined (Kress, 2010; Jewitt, 2013; Bezemer and Kress, 2016; Jewitt et al., 2016). In viewing the pupils as sign-makers their subsequent meanings are orchestrated by (the coming together of) the choices and configurations of modes made available from within the context and setting (Kress, 2010; Bezemer and Kress, 2016).

Multimodal social semiotics questions how different modes orchestrate meaning and communication, such as lowering of the chin in combination with prolonged gaze, could be a prompt for the other person to engage in non-verbal dialogue. The participants' meanings are materialised through signs (or prompts) where every sign has the potential to show learning (Bezemer and Kress, 2016, p.3). This learning may be captured through the pupils' transformations and/or transductions where a change in modes, resources or activity occurs (Breeze, 2008; Pramling and Wellerstedt, 2009; Bezemer and Kress, 2016). For example, in paired work when one pupil puts on headphones (a prompt) it could signify to the other pupil that something is going to happen. What that something is, is often attended to by a further selection of modes. Should the same pupil then choose to play the keyboard, meaning becomes materialised and shows possible learning, known as a sign of learning. Thereby, as researchers and teachers, we can hypothetically recover meanings through instances of non-verbal communication, selected modes and the resources of modes as all modes contribute to meaning (Kress, 2010; Bezemer and Jewitt, 2010; Bezemer and Kress, 2016).

3.3.1 Preceding Modal Prompt

The notion of '*preceding modal prompt*' frames the boundaries of each instance of non-verbal communication (Bezemer and Mavers, 2011). It is useful in this study as I am

looking at how one mode confirms what is going on in the remainder of the instance of non-verbal communication (also referred to as an '*episode*'). The prompt is usually generated by one sign-maker and could have one mode or several modes (Bezemer and Kress, 2016). All modes are considered as being equally available for representation (Bezemer and Kress, 2016; Jewitt et al., 2016). Therefore, the theory shows how one mode ratifies the other and prompts the use of another mode(s).

3.3.2 Transduction

Transduction is defined as the remaking of meaning across modes (MODE, 2012, n.p.). For example, Unsworth and Mills (2020) asked their participants to read an animated book and then to remake the same story using Lego. Jewitt et al. (2001) and Pramling and Wallerstedt (2009) describe transduction as an analytical process in order to show how learning materialises, e.g. pupils listening to the sound of music and dancing in time. However, in my study, the notion of transduction will be used as an analytical tool to examine whether and how learning materialises across digital and non-digital resources. One possible example of a transduction could emphasise pupils' semiotic changes between staff notation (writing musical notes with a pen on manuscript paper), and that of digitally generated notation.

3.3.3 Transformation of Resources

In my study, the concept of '*transformation of resources*' will be a useful analytical tool. It will enable identification of the sign-maker's interactions that arise in response to different prompts. The pupils 'signs' of engagement will only be realised when they orchestrate different ensembles of modes, and their resources of mode (Bezemer and Kress, 2016). This means that within the context of interaction, or the process of interaction (Nijs and Bremmer, 2019), when change occurs there are possibilities for signs of learning to emerge (Kress, 2010; Bezemer and Kress, 2016).

Several studies in music education have used transformation of resources, with differing analytical and multimodal perspectives, but agree that the concept of transformation shows change in learning (Breeze, 2008; Pramling and Wallerstedt, 2009; Nijs and

Bremmer, 2019). Kress and van Leeuwen (2001) note that transformation resides in the *design of the activities* where any change brings together the sign-makers' interest and resources to create a text. In my study, the pupils' interest and resources could refer to computer-generated sounds that they listen to through headphones, in which the sound becomes the multimodal text.

This study will use a multimodal social semiotic understanding of transformation of resources, referring to changes of resources being made within the same mode, to emphasise new meanings or signs of learning (Jewitt et al., 2016). The sign of learning may be a change in the direction of gaze, where the pupils' gaze moves from looking at the computer screen to becoming focused on the movement of their hands on a MIDI keyboard. In this example, the change in direction and intensity of the gaze creates new meaning and potentially a sign of learning. This approach highlights the importance of recognising subtle non-verbal cues as indicators of learning, which can provide deeper insights into the learning process. By focusing on these transformations, researchers can better understand how pupils engage with and internalise new information.

3.4 Design and Design for Learning

This section considers the pupil's '*design*' and '*design for learning*' from the perspective of multimodal social semiotics and how these concepts provide an interpretive tool to help me theorise about the pupils' interactions. Both concepts are useful for understanding the pupils' design of compositional activities through their transformations of resources and for considering their design for learning within the context of the task. 'Designs for learning has been elaborated at the crossroad between social semiotics and Vygotskian inspired socio-cultural theories' (Selander, 2008, p.11). This means that sign-making and sign interpretation is framed by the social context. In this study, the context of the school music classroom frames social relations and knowledge domains in which the pupil's meaning-making takes place. Kress's (2010) definition of design aims to explain the sign-maker's agency and engagement through the resources they choose to communicate with. In contrast, design for learning takes into account the semiotic resources and the choices that learners make, and engage

with, to represent their social world (Bezemer and Kress, 2016). The remainder of this section elaborates on design, followed by design for learning.

3.4.1 Design

Design is one element within multimodal communication linking with other concepts of discourse, production and distribution (Kress and van Leeuwen, 2001) and its key purpose is to provide the researcher with an analytical and interpretative tool to make sense of the pupils' semiotic actions. In this study, the concept of design refers to pupils' engagement with technology and other music-related resources (e.g. worksheets), through a number of available modes (Kress and van Leeuwen, 2001; Kress, 2010). Therefore, design allows me to theorise about the pupils' meaning-making processes as they engage in computer-based activities whilst working towards the final product, the composition.

In this study, I am examining two pupils' instances of non-verbal communication while they engage in computer-based compositional task. This means that I am examining the pupils' multimodal interaction as an instance of design, and further consider the compositional product as another instance of their design. Therefore, in this study I use Kress and Selander's (2012, p.266) established definition of design:

- the planning of something new to happen;
- the shaping of products; and
- the shaping of social interaction.

Design can be better understood as a means to form new ideas, concepts and patterns for shaping new products (Kress and Selander, 2012, p.265). As such, design is described as the coming together of different modes which the individual organises and arranges to form meaning (Kress et al., 2021). It informs an individual's communication, choice of resources and meaning-making (Kress, 1997). In this study, that means the pupils are individual agents where their actions (or inactions) communicate engagement. As the designers, the pupils' perspective would focus on shaping the message in regard to what resources are apt to communicate their choices and decisions (Kress, 2010). These signs

of engagement begin to shape the task's outcome and establish how the pupils may have generated a particular musical idea or a different aspect of the composition, e.g. recording a melody. Therefore, consideration is given to how different multimodal processes coherently work together to provide an understanding of the designer's social practice.

In multimodal social semiotic theory, the teacher may be considered as a designer of the task in which learning objectives and assessment criteria would be set as a part of normal practice. A critique of the teacher's practice recognises they have knowledge of musical language, devices and compositional processes, all of which are incorporated into their design. The teacher's awareness of the setting should then account for the pupil's access to equipment in order to complete the task, e.g. computer-based music composition may need a MIDI keyboard. As with any design of a classroom task, the teacher will be obligated to conform to additional societal positions, in this case, the English National Music Curriculum (DfE, 2013), and this has the potential to place limitations on the design of the task (Kress and van Leeuwen, 2001; Kress, 2010; Kress and Selander, 2012). This means that the initial task design may be limited to the teacher's own technical and musical competencies as well as preferences (Pitts and Kwami, 2002; Cain, 2004; Wise et al., 2011; Himonides, 2012). Therefore, examining the teacher's design does not account for the communication and learning of the recipients.

3.4.2 Design for Learning

Design for learning is a term that draws on the theoretical assumptions of multimodality and assumes particular coherence with its aim of understanding the participants' engagement, representation and communication (Kress, 2010). As mentioned in this chapter, the pupil's interest, semiotic resources and choices they make, and engage with, to make sense of their social world are of significance (Bezemer and Kress, 2016). Furthermore, multimodal social semiotics defines learning as a transformation (change) of people's resources where 'every sign is a sign of learning and that every mode shapes the learner's engagement and offers an insight into their design for learning' (Bezemer and Kress, 2016, p.61). This perspective of multimodal social semiotic learning, as communication (Kress and Selander, 2012, p.267), is different from other research fields

and is useful in my study as it provides a means to theorise about what actually happens in the pupils' instances of non-verbal ('silent') communication.

The notion of engagement considers how participants may co-construct ideas with other people, through using the available resources and technology, within a particular environment or context. This notion of engagement has been discussed in terms of 'signs' and 'signs of learning' (see Section 3.2) in which researchers seek to recognise how learners engage and respond to their social world (Kress, 2010). Representation and communication are two distinct social practices that come together to create meaning. According to Kress (2010), representation involves the depiction or portrayal of ideas, while communication involves the exchange of these ideas. Kress et al. (2021) further explain that both representation and interpretation are essential for meaning-making.

Within the context of this thesis, an example of pupils' representation will show their musical interests: in the music lesson, within the task and in their compositional approach, through the modes, and resources of modes they have chosen, whereas communication considers how pupils' make their social practice explicit to others. Previously explained, the choices participants make through the selection of modes and their resources show the most apt way to communicate. What materialises as a result of those decisions is indicative of the participants' interests and is likely to show transformation of resources, thus communicating their specific learning (Bezemer and Kress, 2016). It enables an examination of the participants' signs, and questions the salience of who, what and how signs are recognised within an activity between the social actors and how technology mediates such learning.

The notion of recognition, and its consequences, are associated with Kress's (2010) theory of learning where I am predominantly interested in the pupil's sign-making processes in their semiotic work, rather than solely focusing on the final compositional product. The work in this thesis assumes a broad interpretation of progress that is ancillary to the teacher's planned outcomes. As such, the lessons learning objectives (Appendix A), the assessment criteria (Appendix B) or the English Music National Curriculum goals (DfE, 2013) are taken as being external to the meanings that arise in

the interactions of the pupils. However, whilst I recognise the pupils' overall objective is to produce an end product (i.e. the composition), the key to understanding design for learning lies in the pupils' interactions and communication.

3.5 Principles of Recontextualization

In this study's context, recontextualization draws on four principles of framing, selection, arrangement and foregrounding (Bezemer and Kress, 2016) which provides analytical and interpretative concepts from which to examine the pupils' semiotic work. Bezemer and Kress (2016, p.75) describe recontextualization as a semiotic process where modes and media are transposed from the originating source (i.e. a secondary school music classroom) to another context such as a text-based transcript. The theory is built on multimodal social semiotic assumptions of remaking or reshaping meaning (Bezemer and Jewitt, 2010; Bezemer and Kress, 2016). Therefore, the four principles of recontextualization will be useful in my study as they enable me to ask specific questions of the data that form the different stages of my methodology and analytical framework (see Chapter Four).

The first principle, framing, is broadly regarded as attending to how an aspect of the world is framed, allowing theoretical inferences to be made (Kress, 2010). More specifically, framing contributes to the theoretical and analytical framework, setting out the boundaries of the data that will inform the analysis and interpretation (Bezemer and Kress, 2016). Framing considers the entirety of the data corpus and asks; what aspect of the pupils' semiotic work is my study framing and how will this be achieved? The theory argues that all elements in the space, defined in this study as an episode, are (treated as) significant (MODE, 2012, n.p.; Bezemer and Kress, 2016). Framing links researcher's interests with the study's main research question in order to frame instances that are significant of the pupils' semiotic work (Bezemer and Kress, 2016). Therefore, in my study, I am framing the pupils' instances of non-verbal ('silent') communication to enable fine-grained analysis of their meaning-making processes that subsequently informs learning.

Selection provides criteria to guide the researcher's choices in examining the semiotic resources available for communication within the framed instance. Although this criterion is not given, *per se*, Bezemer and Kress (2016, p.77) suggest selection involves asking questions of the specific context:

- What is significant for analytical purposes?
- What semiotic resources has the pupil selected for transformation?
- What meaning is being represented, and how?

These questions, and the principle of selection, are useful in this study to examine the pupils' sign-making processes, transformations of resources and new signs of learning that exist in their instances of non-verbal communication.

The principles of arrangement and foregrounding detail the researcher's involvement and decision-making in the overall reshaping (and design) of the pupils' meaning-making, theoretically defined as 'transposition of theory' (Bezemer and Kress, 2016). Arrangement has significance in identifying pupils' signs, transformations of resources and the decisions I make in representing their semiotic work in a transcript.

The principle of foregrounding moves forward these decisions by examining the significance of each frame, mode, resource or sign within the context. It foregrounds the most salient modes available for communication to help show the pupils' signs of learning. Communication may only occur through the pupil's gesture and in using the four principles of recontextualization, the significance of modes, and their resources during the pupils' transformations become foregrounded.

3.6 Chapter Summary

The study's conceptual framework is rooted in multimodal social semiotics in which the framework encompasses several concepts to examine instances of non-verbal communication within the context of a UK secondary school music classroom. The study emphasises the importance of meaning-making through social and cultural shaping of modes. As a result, communication and signs of learning become identified through the

use of different *modes* and the *resources of modes*. Secondly, the *preceding modal prompt* highlights how one mode can confirm and prompt the use of other modes. This concept supports the use of analytical tools which can identify interactions and signs of learning. For instance, *transduction* (remaking meanings across modes) and *transformation of resources* (changes within the same mode) can indicate new meanings or signs of learning. Next, *design* and *design for learning* are used to understand and interpret the pupils' engagement and provide insights into how they communicate and make meaning. Lastly, *recontextualization* is a semiotic process. This process involves principles of framing, selection, arrangement and foregrounding, employed to examine the pupils' sign-making processes, transformations of resources and signs of learning, in which modes and media transpose from their originating source to another context. This comprehensive framework provides a robust foundation for the study's exploration of non-verbal communication in the context of computer-based composition in a Key Stage 3 music classroom and aims to highlight the nuanced ways in which pupils engage and learn.

The research in this thesis accepts Bezemer and Kress (2016) framework as an apt means to recognise, make visible and audibly attend to the significance of pupils' instances of non-verbal communication as they compose using computer-based technology. Originality in the thesis, is the application and transposition of theory to selected instances of non-verbal communication in order to attend to something that no-one has examined before. The approach outlined in Chapter Four (Methodology) will enable the recognition that communication is happening in the pupils' silence as they attend to their compositional work.

4.0 Chapter Four: Methodology

4.1 Introduction

The introduction to Chapter Four explains the methodological decisions underpinning the research in this thesis and is followed by nine further sections. Section 4.2 addresses the study's research design and the main research question. Section 4.3 outlines the research context, including the host school and participants. Section 4.4 defines the methods for data collection, combining digital methods (Camtasia software and a separate small camera) with traditional means, such as documentary data, observation field notes and the researcher's journal. Section 4.5 explains how the theory of multimodal social semiotics is transposed into the analytical framework to address the framing and generation of data and the principles of recontextualization (Bezemer and Kress, 2016). Section 4.6 attends to the particulars of multimodal transcription and issues of social semiotic analysis. Sections 4.7 and 4.8 attend to the trustworthiness of the research and my reflexivity. Section 4.9 details this study's ethical considerations before concluding the chapter in Section 4.10.

The research in this study aims to explore how pupils' modes of communication can be accessed and understood through their experiences of computer-based music composition. Supported by a multimodal social semiotic framework, the study examines instances of non-verbal communication (also referred to as episodes) that arise for two Year 9 pupils' (aged 13-14) computer-based compositional work. It seeks to understand what really occurs during these non-verbal ('silent') moments and how multimodality can enlighten us to the pupil's design for learning. The pupils' development is assumed to be partially substantiated through the use of computer-based and technology-mediated learning (Crescenzi et al., 2014; Jewitt, Xambo and Price 2015) but the key aim is to understand how the most salient modes, and their resources orchestrate meaning.

4.2 Research Design

Considerable research has been directed towards compositional processes in music education where researchers claim that incubation as time needed for subconscious

thinking (Wallas, 1926), divergent and convergent thinking (Swanwick and Tillman, 1986), subconscious imagery (Webster, 1988) and internalisation (Fautley, 2005) are among the approaches people utilise to compose music. What is often ignored, or simply taken for granted (Rostvall and West, 2003; Heath et al., 2010; Bezemer and Kress, 2016) is what happens in those instances of non-verbal communication where the pupils' verbal silence is predominant. Therefore, I am attending to the *banal and everyday* (Mavers, 2009; Bezemer and Kress, 2016) computer-based compositional activities that are situated within the culturally shaped social structure (Goodwin, 2000) of a UK state secondary school music classroom.

The research design is informed by, and adopts, a multimodal social semiotic theoretical framework (Kress, 2010; Bezemer and Kress, 2016). My study is positioned within a qualitative research tradition. It seeks to understand the phenomena of the participants' contemporary communication and learning that is socially situated and contextually framed.

The main research question seeks to understand the participants' silence in computer-based music composition by asking: What is the significance of non-verbal communication ('silence') in the pupils' compositional moments? It is influenced by a constructivist position which views reality as being understood flexibly as connecting 'the world and objects in the world' and where multiple meanings exist (Crotty, 1998, p.44). The study further acknowledges that the construction of the participants' reality is subjective, has the potential to vary over length of the research and may not be generalisable.

This study takes an interpretivist epistemological position which is contextually framed through the participants' social practices of music composition and interaction. It assumes knowledge is shaped through their choices, availability of modes and their resources, and thereby rejects the notion of cognitive psychology (Fautley, 2005) and inner signs (Kress, 2010). However, using video and the principles of recontextualization (Bezemer and Kress, 2016), recognises knowledge is a partial representation and researcher-bound (Bateson, 1979).

Epistemologically this research argues there is importance in examining that ‘being silent *‘means’*, as does not being silent’ (Bezemer and Kress 2016, p.22). Multimodality is the most apt theoretical framework that allows me to recognise this. Thereby, this study foregrounds and considers those neglected instances of non-verbal communication to make visible two pupils' semiotic work, interaction and meaning-making. I am implementing a theory for communication and meaning-making that seeks to recognise the pupils’ signs of learning through the differences in modes and their resources. I am not assessing the lesson’s learning objectives, the assessment criteria, nor the teacher’s design for learning which includes the school’s Scheme of Work (Appendix A) and the English National Music Curriculum (DfE, 2013).

4.3 Research Context - The School and Pupils

This section explains the selection of the school and the pupil participants for the main study, which was conducted in a secondary school.

4.3.1 Selecting the School

A school in which to conduct the research was sought based on the following selection criteria:

- a good or outstanding school, as rated from the school’s last Ofsted Full Inspection;
- evidence that the school taught or followed the English National Music Curriculum (DfE, 2013);
- the music department having its own suite or music technology classroom with computers;
- evidence that computer-based music composition was included within the Key Stage 3 music curriculum; and
- finally, a pragmatic consideration, the selected school had to be within reasonable driving distance for a day visit.

A shortlist of nine schools meeting these criteria was made using the Government database search engine, 'Find and compare schools in England' (Crown, 2015), and by searching the school's websites and curriculum prospectuses. Any school where I had existing professional relationships with the music staff were excluded. Although this research acknowledges its dependence upon subjective positioning, the aim was to minimise researcher influence on all the participants as far as possible.

During the search process it became clear from the curriculum information available on the websites that sometimes it was not until Year 9 that pupils had access and opportunities to compose with computer technology; pupils in Years 7 and 8 (in Key Stage 3) were sometimes excluded from such opportunities. Thereby, selecting an appropriate year group to research in Key Stage 3 was limited to classes that both had access to computer technology and identified a specific compositional component as a part of the school's music curriculum.

Of the nine schools contacted, two responded asking for further information. One of these then declined due to staffing issues and the other agreed to participate in the research.

4.3.2 Rationale for Focusing on Two Pupils

A number of scholars have provided empirical evidence showing the gains in using qualitative and multimodal research with only a small number of participants (Dillon, 1989; Goodwin, 2000; Rostvall and West, 2003; Mavers, 2009; Cowan, 2014; Ravelli and van Leeuwen, 2018; Unsworth and Mills, 2020; Djonov et al., 2021). They explain that multimodal theory recognises the complex and intricate nature of communication, and a small number of participants generates rich data. Furthermore, Bezemer and Kress (2016) assert that at least two participants are required to examine learning and communication but acknowledge that social and active engagement can occur with just one of those participants. Wider research literature supports the notion that the minimum number of participants of two, is acceptable in research attending to social situations and activities (Yates, 2003; Maxwell, 2005; Slekar, 2005). The argument for small numbers of participants extends to how analysis can best show the complex

phenomena where Yates (2003, p.224) notes that, 'the point of dealing with a small number of subjects in a lot of detail is to see the specificity and context in fine grain.'

Another consideration for the research was the potentiality of participant absences. Ethically, it was questionable whether collecting data that reflected one pupil's experiences would maintain trustworthiness and how the pupil would feel having the full attention on them without peer support. This scenario posed a situational dilemma that needed to address pupil absenteeism and the cause of unnecessary stress. As a qualitative researcher, being flexible would appear to accommodate the unforeseen circumstances (Denscombe, 2014). However, this study's rationale seeks semiotic action relying on social interactions between participants, modes and their resources of modes. Therefore, in the event of a pupil being absent, I would forgo the observation so as not to cause the pupil any undue or unnecessary stress, nor compromise the research design. Fortunately, pupil absence did not occur.

4.3.3 The Selection Process for Participants

The selection criteria were generated as an outcome to a supervision discussion and my prior experience as a researcher. Two pupil participants were selected based on the criteria outlined below:

- access to composition task using music technology for a half term and in the same music class;
- participant pairings must not include siblings or other family relations pairings, e.g. twins or cousins;
- within a range of educational abilities but precluding Special Educational Needs and Disabilities;
- excellent attendance in music lessons, i.e. no more than one absence per half term;
- may have had instrumental lessons, e.g. in primary school, but not necessarily continued in a secondary school environment; and
- a willingness to agree to the whole research project of approximately six to eight weeks [one half term].

Further consideration was given to dates and times for the Year 9 music lessons (Week A and B). These were forwarded via email. The purpose of knowing timetabling information allowed for scheduling observations.

4.3.4 The Role of the Music Teacher in the Research

The school's small music department had two staff members: the departmental head and a specialist music teacher. They were afforded the same rights as the pupil participants and received this study's information sheet and consent forms. Both the departmental head and the music teacher gave their written consent and waived their rights to full anonymity (BERA, 2011). That meant the use of images, screenshots, short video clips and audio and/or musical recordings from Camtasia could provide contextual information to the setting and the pupils' task. Additionally, both music professionals agreed to the use of anonymised quotes and ongoing verbal consent was obtained throughout the duration of the study.

Observing the teacher in music lessons would have detracted from the research's aims which regard the participants as central to the investigation. The teacher's presence was expected in every lesson where their role offered all of the pupils: guidance, instruction and criticism of their progression, as well as monitoring time and pupil behaviour. It was possible that the teacher-pupil interactions could alter the pupils' meaning-making potentials. As such, it was necessary to consider the teacher as part of the pupils' learning experiences. These instances were documented.

4.4 Methods for Data Collection

This section considers the methods used for data collection. There are five subsections covering the use of: Camtasia, one small camera, documentary data, observational field notes and my research journal.

4.4.1 Camtasia

In this study I used Camtasia™ – a computer screen capture program in which the software records real-time interactions of a person's decisions and steps taken to engage in and complete a computer-based compositional task. This tool made it possible to record the software's visual and sound representations where the pupils' computer-generated sounds and compositional decisions would be captured, e.g. searching for an instrument using the mouse or the section being attended to when editing. As the school's computer had an integrated camera, pupils' non-verbal communication was seen through their engagement with different modes (e.g. movements or gaze) and resources of modes (e.g. direction and intensity of gazes). Using Camtasia enabled a full ensemble of modes to be available for communication that would otherwise be missed through observation alone (Plowman and Stephen, 2008; Jewitt et al., 2009).

Figures 4.1 (p.89) and 4.2 (p.91) are screenshots from the second music lesson's recording, as captured on Camtasia. They are shown here for three purposes. First, as orientation, to support the reader in understanding how the pupils' modes of communication begin to be mediated through the technology. Second, the screenshots show different visual functions from the computer's software in which pupils have chosen to use to attend to their composition. This is in no means a full visual representation of the software but illustrates the generic setup from which the pupils compose, record, edit and refine their work. Noted is the lack of sound that cannot be attached to the screenshot in this written format. Lastly, the screenshots further support the notion that 'different media represents different types of knowledge' (Pink, 2013, p.144). For example, within the software we can see there is the inclusion of the Dr Who clip (BBC, 2012) adding sound effects, movement and speech. Other considerations include the images, icons, colours and words which combine different media to create a complex multimodal text. The question becomes what knowledge can be interpreted from the screenshot? Taken together, the implications question the availability of modes or media to generate and frame the data, which is then reflected in the design and mapping of instances of non-verbal communication and its subsequent analysis.

Figure 4.1 gives the view of the screen that pupils (and the teacher) would have when using GarageBand. The labels show the density and complexity of the information available through the visual representation of GarageBand's interface. Media have been added to the software in the form of two tracks: the Dr Who clip (BBC, 2012) and its subsequent audio track. Kress and van Leeuwen (2001) would suggest this perspective represents a multimodal text as it includes the modes of colour, sound, icons, images, written text and moving image. It further indicates other features for example: the temporality through the composed motif tracks or the bar being attended to, the software-specific toolbar with drop-down menus and operational icons which direct several compositional functions, i.e. recording.

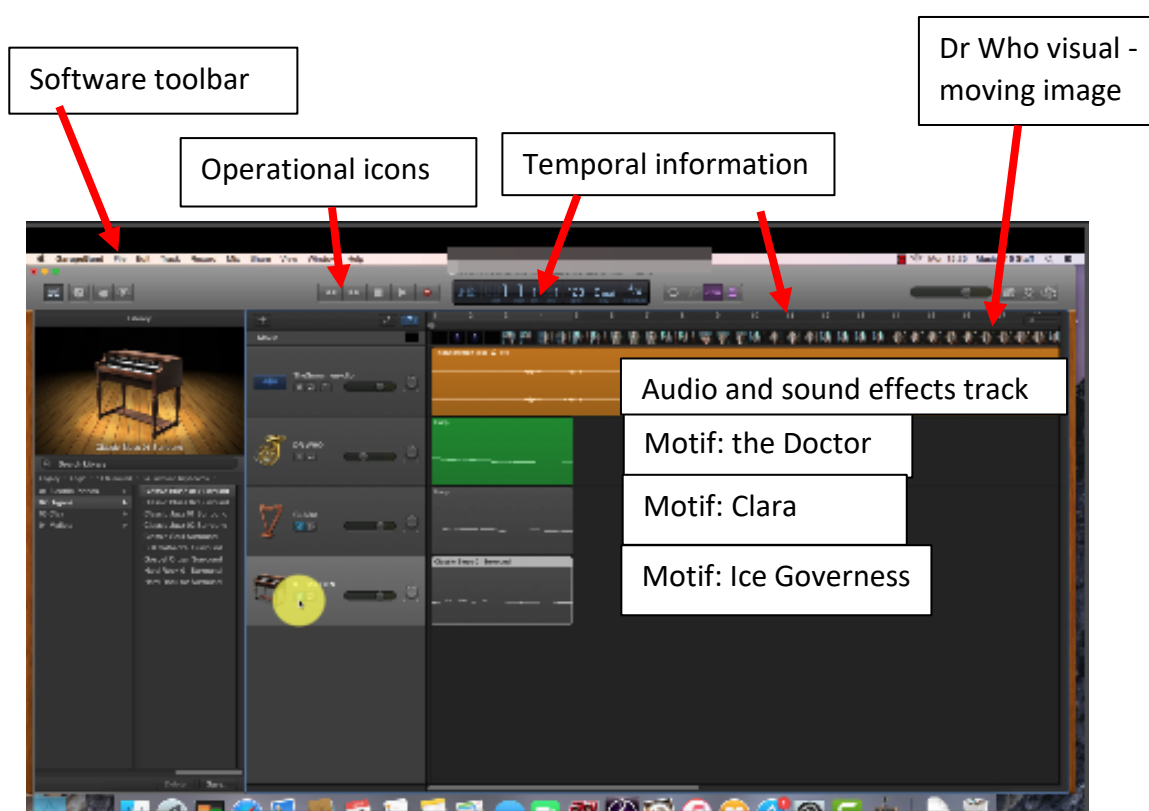


Figure 4.1: Screenshot taken from Lesson Two: the pupils and teacher view of GarageBand

The cost of Camtasia and its licensing restrictions meant only two participants could have been recorded using the software. This presented risks, such as loss of data if a participant withdrew, but I judged this was offset by the depth and 'richness' of multimodal data that could have been collected (Denscombe, 2014).

The use of Camtasia raises particular ethical issues that are examined in Section 4.9 of this chapter. However, those permissions were sought and received to allow both participants' and teacher's inclusion in this study.

4.4.2 Video Captured with a Small Camera

In qualitative research, the use of video recording is a well-established method for capturing participant observations and interactions within classroom contexts (Bassey, 2010). Different studies have used video recording in diverse ways that are appropriate to the availability of technology and its advancements. The literature of multimodality and music education illustrates three distinctive recording methods: videotaped recordings (Seddon, 2001; Fautley, 2005), videotaped with some digital recording (Gall and Breeze, 2008) and finally digital recordings to capture technology-based classroom learning (e.g. Flewitt, 2006; Erickson, 2006, 2007; Flewitt, Hampel, Hauck and Lancaster, 2011; Crescenzi et al., 2014).

Within the diverse perspectives of multimodality videoing is widely employed as a methodological tool (Derry et al., 2010; Heath et al., 2010; Pink, 2013; Jewitt et al., 2016). A good example is illustrated in Crescenzi et al. (2014) who created an additional iPad cover in which four micro-cameras were placed. Their integrated approach to videoing had less of an effect on the young participants and avoided any potential change to behaviours. This point is argued to have reported gains in the data corpus which may have otherwise been difficult to obtain on mobile devices. Although my study uses a computer workstation, the literature has consistently shown that, in multimodality, video data often forms the primary source in which data is selected for analysis.

In addition to Camtasia (see Section 4.4.1), I used a small digital Sony camera on a small tripod. The camera was positioned on the left-hand side of the participants, focusing on the mouse, hand gestures and two keyboards (QWERTY and MIDI). No sound was recorded through this device. The in-built computer camera was angled in such a way that it would not capture these modes, meaning this data would have been lost. Therefore, the side camera provided an altogether different perspective that captured

the pupils' semiotic choices and some unanticipated communication through movements, such as when they left the computer workspace. This data offers a different view from that of the pupils' backs, as obtained during the observational process (Jordan and Henderson, 1995).

Figure 4.2 shows a screenshot of the types of visual data available from Camtasia and the small camera. The picture on the bottom left labelled as 'data capture from the small camera tripod' was manually synchronised or imported into Camtasia. This process was fairly straight forward, but I needed to ensure synchronicity and consistency of real time between the video and Camtasia data. The yellow circle was a function provided by Camtasia that illuminated all of the movement generated by the mouse. The picture on the right-hand side shows Ollie and Alex (the participants and their pseudonyms) from the view captured by the computer's integrated camera. The researcher or teacher does not often see this particular perspective, and it is from this view that the pupils' semiotic work becomes visible.

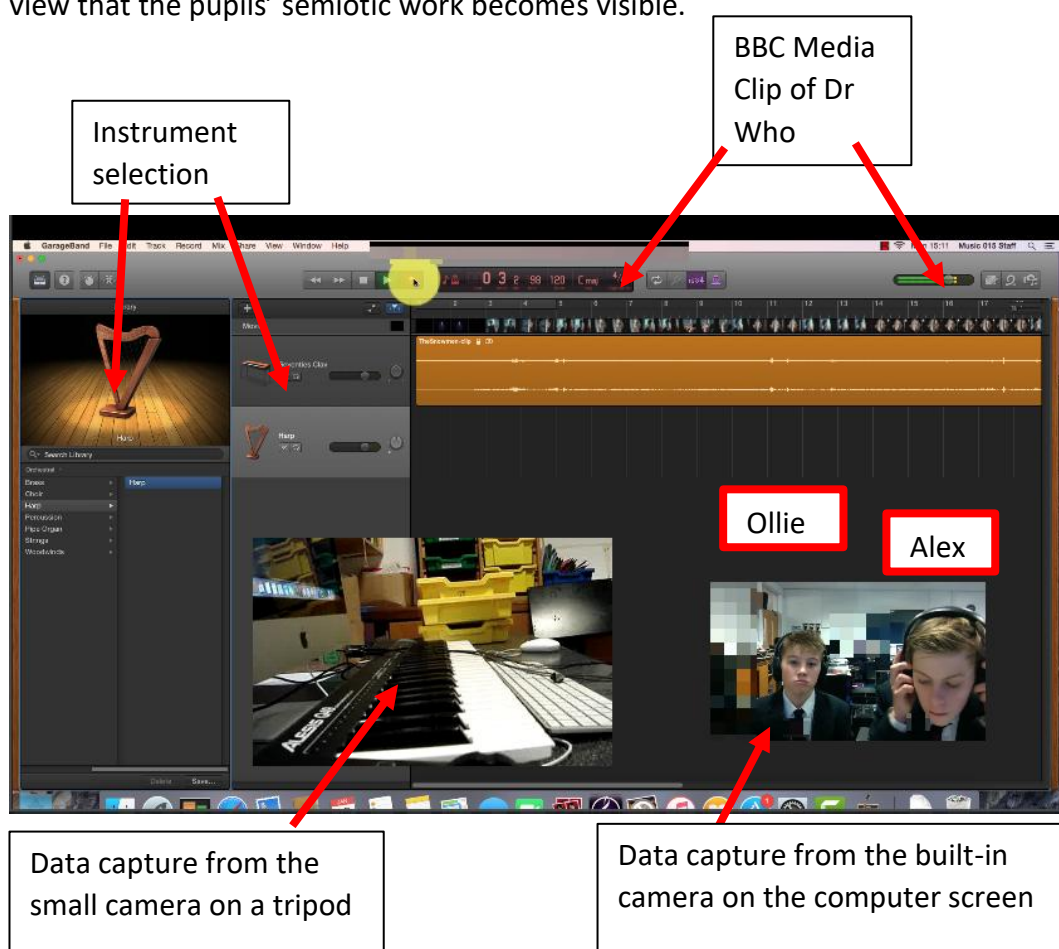


Figure 4.2: Screenshot from Lesson Two: the researchers view

4.4.3 Documentary Data

Documentary data came from three sources:

- the school's Scheme of Work (Appendix A);
- the pupils' activity worksheets (Appendix C); and
- the pupils' assessment criteria (Appendix B).

In applying multimodal social semiotics theory of communication, these documents are understood as textual artefacts and/or multimodal texts that serve a specific purpose within the teacher's pedagogical design (Jewitt and Kress, 2003). The pupils' activity worksheets and assessment criteria were identified as texts that may have supported their design for learning (Appendix C and Appendix B).

The Scheme of Work (Appendix A) provided insights into the teacher's expectations of the compositional strategies pupils would use. One example illustrates where the teacher planned to lead a discussion about choosing key signatures, followed by directing the pupils to adapt their composition to reflect their chosen key. As a text, the document provided a remote point of reference to the teacher's design for learning that is consistent with the English National Music Curriculum expectations (DfE, 2013; 2013a). Examining the text identified possible multimodal social semiotic interactions and indicated where there was potential for the pupils' meaning-making to emerge (Jewitt and Kress, 2003; Kress, Jewitt, Jones, Franks and Hardcastle, 2005).

The school's Scheme of Work (Appendix A), pupils' activity worksheets (Appendix C) and pupils' assessment criteria (Appendix B) are not considered primary data sources for analytical purposes. These documents will periodically be referred to in the analysis as each one provides specific contextual information about the nature of different activities. However, it is important to recognise that the pupils may, or may not, attend to these activities where they may also, or may not, use the worksheet or assessment criteria provided by the teacher. Selection of additional resources are likely to be dependent on the pupils in situ choices and interests and cannot be anticipated (Bezemer and Kress, 2016).

4.4.4 Observation and Field Notes

In addition to the video and Camtasia data, field notes were made as events emerged as recommended by Bezemer and Mavers (2011) and Cohen, Manion and Morrison (2018). I was careful not to overly rely on my interpretations of what was occurring. Instead, I tried to describe the pupil's actions without adding my opinion. As a former music teacher, it is inevitable that my field notes are subjective in nature (e.g. noting the pupils' compositional activities), and I acknowledge this fact. The field notes serve to contextualise this study and to provide a holistic account of invisible data not captured on Camtasia. All artefacts from the research are considered valuable in multimodal social semiotic analysis (Jewitt et al., 2016), not only as a means of data familiarisation, but to locate this study within the wider field of representation and communication.

Spanning over two pages, I logged the date and lesson time, weather, ambience and atmosphere of the classroom before the lesson and observation began. This contextual data could affect the overall meaning-making of the individual, the signs they used to communicate, the signs they attended to and/or ignored and thereby have some influence on their overall design for learning and modes of communication. Other information such as: behaviour of pupils, temperature of the learning environment, learning objective displayed and/or discussed was also included to support contextualisation.

Detailed in the list are three areas in which notes were made against:

- a timeline of pupils' interactions and communication. The process involved looking for 'in the moment of what's going on' and further noted instances of silence or non-verbal communication;
- description of the objects, modes and/or semiotic resources used during instances of pupils' non-verbal communication; and
- the sign maker's interest (and whom) and whether this signified possible meaning-making?

The information noted was subsequently drawn upon in the analysis. The data was used to contextualise each lesson, aiming to provide the reader with a richer understanding of the pupils' experiences and highlight salient aspects not visible in the analytical representations.

4.4.5 Researcher Journal

Initially, I documented the different research stages throughout the entire research journey from 2013. The journal was more regularly updated throughout the data collection and analytical processes, though less so in the later stages when writing the thesis took over. Its purpose was to record my thoughts, concerns, questions, decisions and personal reflections on the research process. These notes were either actioned at the time (e.g. adjust volume in computer settings prior to recording), commented on in the thesis as part of the reflectivity during data analysis, or left for later development. An integral notion of this framework acknowledges that I am part of the construction and interpretation process where 'data in qualitative research must be found' (Erickson, 2004, p.486). Berger (1972, p.1) contests 'the way we see things is affected by what we know or what we believe', which is inherently steeped in my prior experiences as a music teacher. Multimodal theory attends to both concerns whereby the construction of datum is constantly identified and defined (Erickson, 2004) through the principles of recontextualization (Bezemer and Kress, 2016) and an ongoing reflexive process. That means continually asking, and making clear, the types of questions of which I am asking of the data. This approach underscores the importance of reflexivity in qualitative research, ensuring that the researcher's influence is acknowledged and critically examined, thereby enhancing the trustworthiness and depth of the study.

4.5 Generating and Framing the Data

The notion of generating and framing the data is consistent with multimodal social semiotic theory (Bezemer and Kress, 2016). It acknowledges that my role is to 'generate', or construct, the data set from the collected qualitative data (Erickson, 2004), prior to any analysis. 'Framing' considers how much of the video data will be used to represent the pupils' instances of non-verbal communication. It also questions

how the boundaries of an episode are defined, which modes and resources of modes will be made available to represent the pupils' meanings together with the transcript design.

A number of scholars have considered the implications of multimodal transcription, and transcription more generally (Bezemer and Mavers, 2011; Flewitt et al., 2011; Bezemer and Kress, 2016; Jewitt et al., 2016). These authors all suggest that the roots of multimodal transcription inherently reside within language and linguistic practices. Having the observation captured on video, or in this study with Camtasia and digital video, makes available different potentials and possibilities in how the modes can orchestrate the pupils' meanings (Bezemer and Jewitt, 2010; Bezemer and Kress, 2016). As a wide range of modes were expected to be available for analysis, the challenge then became interpreting which modes were salient to the pupils' meaning-making (Jewitt et al., 2016).

Bezemer (2014) evaluated the impact of selection principles with multimodal transcripts ascertaining two prominent points. First, using video requires the researcher to be systematic and sequential in the analysis of data, but also, to be aware of what would have been lost through the selection process. The second point examined the potential gains that selection establishes, i.e. depth, breadth and richness 'into the situated construction of social reality' (Bezemer, 2014, p.158).

4.5.1 Stage One - Mapping a Lesson Overview using Camtasia Video

Filtering out verbal communication was the first stage. The process started with the concept of framing, 'bracketed through beginnings and endings' (Bezemer and Jewitt, 2010, p.6) where each lesson generated its own data set. Using the analytical categories of mode, I identified the instances of non-verbal communication by asking: where are the instances of communication without the participants' speech?

The first part of this process required repeated viewing of Camtasia with and without sound as well as temporarily switching off the integrated webcam tracks. In doing so, I identified all eventualities of instances of non-verbal communication which were

greater than ten seconds. Secondly, having identified an episode, markers were added to the Camtasia footage. These markers signified both the start and endings of speech, and a number was assigned to sequentially identify the instance of non-verbal communication within each lesson.

Generating the overall lesson maps involved asking a series of design questions whilst the instances were systematically viewed and reviewed. These questions were:

1. Is the instance of non-verbal communication greater than ten seconds?
2. When does the instance occur in the lesson?
3. What is the duration of the instance?
4. Who is prompting whom, and how?
5. What stands out in the interaction?
6. What objects are being used to compose?
7. What modes are represented in the interaction?

The first three questions formed the first four columns of the overall lesson map (as shown in Figure 4.3, p.99). The seven questions generated answers to address the overall design of the lesson map and included issues of sequential order that framed the start and ending of the instances, positionality within the lesson (and later within the data corpus) and its duration. The modal precedence involved asking what was happening two to three seconds before the framed instance and who prompted whom, and how?

In communication, any kind of text can arise in response to a prompt and assumes a constant semiotic chain (Kress, 1997). The interpretations then made on these occurrences are considered transpositions from theory where Kress (2010) advocates that communication requires interpretation. Having identified all instances of non-verbal communication, the video data sequentially examined each modal precedence by questioning which of the prompts, modes and their resources were salient and in operation seconds prior to the pupils' verbal silence. The selection of preceding modal prompts came from the pupils' interactions and included at least one dominant mode from an ensemble of verbal, action, pointing with the mouse or gesture, gaze, facial

expressions, computer-generated sound and/or body movement or positioning. The fifth column 'preceding modal prompt' frames the beginning of the instance of non-verbal communication without implying a causal relationship to the instance and/or prompt (Norris, 2004). This means that I am not making the assumption that the pupils grasped the cognitive implications of the prompts, and nor were they necessarily responding to them. The mode of speech was accepted as always being present in the preceding moments but was not assumed to be the modal precedence.

The preceding modal prompt was multimodal and always included some form of utterance or speech – shown in the transcript as italics and brackets. In the transcript, bold font indicated which modes took precedence. Lastly, an indication of what was being communicated was briefly outlined. This brief outline entailed noting the modes and resources of modes in operation during the instance of non-verbal communication. Different prompts emerged outlining what the pupils were doing before the instance of non-verbal communication, and these prompts further served as a means to identify what may be occurring within the instance of non-verbal communication.

It is worth mentioning that the prompt may not fully establish what the pupils' might be attending to in their compositional work and that the instance of silence may have had nothing to do with the modal prompt. Although the pupils may follow the traditional voice, or teacher's design for learning, signs of engagement will only be realised when there is materialisation from the process of interaction (Bezemer and Kress, 2016). This means that, within the context of interaction, there are possibilities for transformation to occur. In this study, transformation refers to changes in resources being made within the same mode, to create a sign of learning, whereas transduction considers the remaking of meanings across modes (Bezemer and Kress, 2016). Previously mentioned (Section 3.3.3), a transformation of resources considers each available mode, each having a set of features with specific meaning potentials. For example, gaze could signify the direction and point of attention to which the transformation would show a change of direction, such as focusing on the computer screen to looking out of the window. Therefore, implementing multimodal theory in a systematic way and analysing instances of non-verbal communication (as described in this section) enables the silent episodes to become visible, and to be studied.

Each lesson's overview was presented using the same questions and design. The mode(s) selected were representative from those available in Camtasia video. This meant that the modal prompts were consistent with assumptions of multimodal theory, where they were socially and culturally constructed (Kress, 2010), and further viewed as norms within this study's context of a secondary school music classroom. In total, seven preceding modal prompts were identified: verbal, action, computer-generated sound, movement, gesture, gaze and facial expressions. Figure 4.3 illustrates stage one of the lesson map design and provides a partial transcript from Lesson One – mapping instances of non-verbal communication using the Camtasia data.

Instance	Start time in minutes and seconds	Time Ends	Duration in seconds	Preceding Modal Prompt	Description of Episode
1	01:55	02:06	11	Teacher's verbal instructions: (<i>remember I want to see what scale you're going for</i>) repeated twice Student One (Alex) movement and speech (<i>we need a bass or something to start off . so basically</i>) Student Two (Ollie) action keyboard	Pupils settling down Teacher continues with verbal instructions
2	02:41	03:01	20	Alex notation Ollie speech; gaze and notating on worksheet (<i>key A to A</i>)	Notating the key signature and Alex plays the scale on keyboard
3	03:22	03:40	18	Teacher's verbal response + gesture to Alex question (<i>the triads I'm just putting on the board</i>) Alex (<i>oh okay</i>) + turning movement Ollie aural + action	Alex continuation of notation on worksheet + gaze at board. Ollie gazes across room then plays keyboard
4	03:50	04:00	10	Alex verbal instruction to Ollie (inaudible) then (<i>never mind</i>) Ollie movement towards partner + gesture	Alex continues to notate Ollie plays keyboard
5	04:02	04:14	12	Alex notation + speech (<i>yeah, got it right</i>) Ollie action playing keyboard	Alex continuation of notation on worksheet + movement and gaze at board Ollie continuation of keyboard playing

Figure 4.3: Stage One of generating and framing the data. Partial lesson map of instances of non-verbal communication (Lesson One)

Each of the four lessons has a transcript mapping all of the available instances of non-verbal communication. Each map varies in length according to the time the pupils spent composing at the computer workstation and the number of silent instances equally vary. The full lesson mappings are available in Appendices D to G.

4.5.2 Stage Two - Mapping Instances of Non-Verbal Communication

This section outlines the procedure in which instances of non-verbal communication, as identified from stage one, were selected for further in-depth multimodal analysis. Sixteen episodes were selected for this analytical stage with four instances of non-verbal communication from each lesson. The lesson map overview provided a systematic approach by giving equal attention to all instances of non-verbal communication greater than ten seconds in length (as defined in section 4.5.1).

The framing of each episode had already been established in stage one where the preceding modal prompt arose, either within the interaction between the pupils, or in the multimodal text of the teacher. Additionally noted were my interests in the pupils' semiotic work from the observational field notes. In the first stage, seven modes were identified as being representative and available as modal prompts and as a means of differentiating different types of non-verbal communication. The salience of which assisted in the selection criteria of choosing the episodes to analyse as categories for interpretation in the mapping.

I mapped out a range of multimodal texts consisting of a representative selection of preceding modal prompts. In each instance of non-verbal communication one dominant mode was often identified from an ensemble of modes (verbal, action, pointing with the mouse or gesture, gaze, facial expressions, computer-generated sound and/or body movement or positioning). Noteworthy, and consistent with multimodal theory, some instances recognised more than one mode as being simultaneously present and of equal precedence to the episode (Bezemer and Kress, 2016; Jewitt et al., 2016). Summarised in Table 4.1 are the selected preceding modal prompts which is also illustrative of the selection of instances of non-verbal communication available for in-depth analysis. I selected four instances of non-verbal communication from each lesson, each illustrating

a different dominant mode but where one of the four episodes was always prompted by verbal communication.

Table 4.1: Summary of the preceding modal prompts

Lesson One	Lesson Two	Lesson Three	Lesson Four
<i>Episode One</i> Teacher's verbal instructions	<i>Episode Six</i> Action (keyboard) and speech	<i>Episode Five</i> Verbal	<i>Episode Four</i> Movement
<i>Episode Two</i> Notation (written language)	<i>Episode Nine</i> Gesture at computer screen, action (mouse and keyboard)	<i>Episode Ten</i> Action (playing keyboard)	<i>Episode Eleven</i> Ollie's verbal suggestion and gesture
<i>Episode Seven</i> Action (keyboard) and sound	<i>Episode Fifteen</i> Alex's verbal instructions and gesture	<i>Episode Eighteen</i> Sound	<i>Episode Twenty-four</i> Action (headphones and mouse)
<i>Episode Eleven</i> Gaze and Ollie's verbal request	<i>Episode Thirty-three</i> Action (mouse and headphones)	<i>Episode Twenty-five</i> Gesture (pointing of mouse)	<i>Episode Forty-two</i> Positioning, gaze and sound

Generating the map of selected instances of non-verbal communication involved asking a second series of design questions which were systematically reviewed and continued to be influenced by the principles of recontextualization (Bezemer and Kress, 2016). These included:

- How would I transfer the data from one medium to another?
- How would the mode of sound, the clips audio and sound effects (BBC, 2012) be included, or omitted?
- What visual representation would be needed?
- How would I frame the sequential and temporal order?
- What was my positionality in the mapping?
- How would I show duration?
- Where would I include the preceding modal prompt?
- Which modes would I include in the mapping?

Figure 4.4 (on p.103) shows the mapping of the resources available for communication from Lesson One Episode Eleven. This map is a partial representation of the eleventh instance of non-verbal communication or as indicated at the top, in bold, [**Lesson 1 Episode 11**]. This information provides a framing device of the episode's sequence within this first lesson. Each map shows the availability of modes and makes visible the pupils' choices and selections that informed their meaning-making. In the mapping, I have framed the preceding modal prompts, i.e. two to three seconds before speech paused (Norris, 2004), as **bold font** and indicated who prompted whom. For instance, in Figure 4.4, Ollie prompted Alex through the modes of **gaze and speech** with instructions (***put your headphones in***). Other framing devices include a time identifier in seconds which shows the position of the episode in the overall lesson, e.g. **12:57** or 12 minutes 57 seconds. Having located the temporal placement of the instance of non-verbal communication the next two columns attend to the available visual data. Two screenshots taken from Camtasia at second intervals. These screenshots form the visual representations of pupils at the computer workstation. Specific data captured from the computer's integrated camera view shows the pupils sitting at, and in front of the computer workstation, and the small camera details a side view of the pupils and the equipment. The remaining six columns are labelled with the categorised modes (from stage one) for interpretation and analysis.

Preceding Modal Prompt [Lesson 1 Episode 11] Ollie gesture; gaze + speech (<i>put your headphones in</i>)								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
12:57 (19)			Alex putting headphones on	Ollie's hands are over the keys on the keyboard	Ollie looks towards his partner		Ollie sits close to the desk, positioned slightly in front of Alex	Ollie headphones on
12:58			Ollie plays the keyboard	Ollie turns head to his right	Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Alex leans to his left; head positioned to see Ollie play the keyboard	Both have headphones on

Figure 4.4: Stage Two of generating and framing the data. Partial representation of the mapping of resources available for communication (Lesson One Episode Eleven)

4.5.3 Operationalisation of the Principles of Recontextualization

The analysis of the mapping drew on the principles of recontextualization (Bezemer and Kress, 2016; Section 3.5) which supported the transposition of theory with the data, in order to locate the pupils' design for learning. It also recognised the complexities of transferring data from one medium (i.e. moving image from Camtasia) to another (i.e. mapping of available resources), which may have an epistemological effect on the reader (Bearne, 2005). However, multimodal social semiotic theory assumes that the unison of spatial and temporal devices can legitimately be represented as interaction in situ when four principles of recontextualization are observed: framing, selection, arrangement and foregrounding (Bezemer and Kress, 2016, pp.76-78).

4.5.3.1 Framing

The process of framing started in stage one (Section 4.5.1) where I implemented multimodal social semiotic theory to identify all instances of non-verbal communication across all four lessons. This meant that I upheld the definition of an episode as the start and endings of the pupils' non-verbal ('silent') communication which lasted for ten seconds or longer. Next, preceding modal prompts were identified for all instances of non-verbal communication in each lesson. A representative selection of modal prompts was chosen for in-depth analysis and one episode per lesson always included speech. This was significant as all modal representations were presented in the mapping.

In stage two, the mapping of resources available for communication is considered semiotic work linking with multimodal social semiotic theory in order to analyse the selected episodes. As such, each mode presented in the mapping has its own resources that support the materiality of the pupils' communication through their choices of modes.

4.5.3.2 Selection

The selection criterion is connected with the configuration of the prompt as it creates a multimodal text involving the pupil's speech. I asked a series of questions that were consistently applied to each second of data. The questions were:

- Who is prompting whom, and how?
- What stands out in the interaction?
- What objects and/or artefacts are being used to compose?
- What modes were being foregrounded?
- How is it that the modes interact?
- What patterns are occurring, if any?
- What is being communicated through this instance?

Consistent with theory, I recognised that the visual of the computer screen was missing and needed to be represented. To address this, I decided to include the episode's first and last frames, as screenshots, for the sixteen instances of non-verbal communication. Research in music education has examined the visual representations of the computer screen (Gall and Breeze, 2008; Hewitt, 2008), but from my study's theoretical perspective screenshots do not explore the pupils' design for learning. What they do establish, is the crystallisation of the pupils' composition and semiotic work at the point the screenshot was taken. It further gives me, as the researcher, an opportunity to consider the remote point of reference to the teacher's Scheme of Work (Appendix A) and what these screenshots may tell me about the pupils' learning.

4.5.3.3 Arrangement

Arrangement has meaning (Bezemer and Kress, 2016, p.77) which refers to the design decisions made for the mappings in both stage one (Section 4.5.1) and stage two (Section 4.5.2) as well as what was produced. Arrangement, however, was seemingly more relevant for the design for the mapping of resources available for communication as discussed in stage two. I was conscious of formulating a map that addressed the

question: what kind of semiotic arrangement will illustrate the pupils' choices and semiotic work?

4.5.3.4 Foregrounding

Within the mapping, I identified which of the modes were foregrounded more than others and which became backgrounded. To illustrate, I provide an example outlining the steps taken to foreground specific modes. First, I ascertained instances where the mode of gaze was prominent in an activity. Next, I considered how the resources of gaze subsequently supported the pupil's communication. This meant the pupil could have been directing their gaze in a particular direction, watching their partner do something or moving their gaze between the computer screen and the keyboard.

The process of foregrounding asked a series of questions specific to multimodality, for example:

- What do the instances of non-verbal communication have in common?
- What modes are in operation within these instances?
- What are the features of the mode?
- What do the modes signify in terms of communicating meanings about learning?
- How is learning evidenced?
- What is the significance of their use?
- How do pupils prompt each other?
- How is a semiotic chain forming within these episodes? and
- Which of the preceding modal prompts are ratified by the episode?

In addition, when completing the analysis, I considered what was missed or represented in a way that differs from normal conventions, i.e. musical and/or computer-generated sound. The intention was to note these instances in my researcher's journal and attend to them at a later point.

4.5.4 Summary of Generating and Framing the Data

In this study, transcripts (and the mapping of them) were more than descriptions or translations; they were theoretically informed by the multimodal social semiotic theory (Kress, 2010). The aim was to illuminate the pupils' semiotic work during their instances of non-verbal communication.

To briefly summarise, stage one of the analytical framework operationalised multimodal social semiotic theory by creating transcripts that mapped the pupils' semiotic work for each lesson. Each lesson's map provided an overview of the availability of instances of non-verbal communication, made visible the available modes and resources of modes, and selection for further in-depth analysis. Thereby, the first stage implemented theory and was criterial to create the data set.

The second stage facilitates a micro-analysis of sixteen selected instances where there was communication without speech. These instances of non-verbal communication were selected for criterial and representative purposes. Interpretations were legitimised by adopting the principles of recontextualization (Bezemer and Kress, 2016) where each principle of framing, selection, arrangement and foregrounding was theoretically informed. As such, the invisible social practices of two pupils' instances of non-verbal communication during compositional activities became visible.

4.6 Analysis and Multimodal Transcription

This section addresses the methodological issues of multimodal social semiotic data analysis and multimodal transcription by examination of the potentialities and limitations such an analytical framework presents. In multimodal theory, these two areas coexist and need to be undertaken simultaneously (Bezemer and Kress, 2016). The remainder of this section presents some fundamental ideas underlying the processes of generating the data, multimodal transcription and justifications supporting the analytical decisions this study made.

To recapitulate from earlier in this chapter, the present study offers a qualitative and interpretative approach to multimodal social semiotic data analysis. The analysis critically examines semiotic markers that emphasise how learning is orchestrated through the use of different modes and the resources of modes. This is achieved through two stages. Firstly, operationalising the theory to create a data set and then secondly a transposition of theory to examine what materialises.

Consistent with multimodal theory, it is generally agreed that it is unnecessary for the entirety of a videoed lesson to be analysed in detail (Plowman and Stephen, 2008; Bezemer and Jewitt, 2010, p.8; Bezemer and Mavers, 2011; Flewitt et al., 2011; Bezemer and Kress, 2016). Furthermore, Erickson (2006) suggests that the data needs to be generated from the video, thus enabling the analytical process. As previously detailed, Camtasia captured the pupils' semiotic work in composing a piece of music using computer-based technology. The pupils made choices in how best to utilise the available resources during instances of non-verbal communication that emphasise their design for learning. Although embedded through the principles of recontextualization - framing, selection, arrangement and foregrounding (Bezemer and Kress, 2016), the starting point for this study also required selection criteria. These criteria are discussed in each stage of the analysis.

4.6.1 Determining the Length of Instances of Non-Verbal Communication

A recurrent methodological problem for this study was determining an apt duration to represent instances of non-verbal communication (or episodes). The purpose was to examine what prompted the silence and to determine an appropriate length in which instances of non-verbal communication could be defined and subsequently mapped. This section explores this problem of episode duration and makes visible my decisions in response to existing literature across the fields of music education, multimodality and video analysis.

A review of the literature revealed that conversational analysis requires detailed and close examination of speech of less than ten seconds. Of particular use, because of its focus on silence, was Maroni's (2011) study which reported timings of the conventions,

such as gaps, pauses and wait time. Although timings were difficult to differentiate, the gaps and pauses often lasted from 1.5 seconds to four seconds, whereas wait time continued for up to ten seconds. Contrastingly, video-based research has been adapted to different theoretical and analytical frameworks, including multimodality (Heath et al., 2010). Although they emphasise *no one convention fits all*, they do indicate that in conversational analysis one fragment of video (or episode) would last longer than ten seconds (Heath et al., 2010, p.110). As this study's theoretical framework adopts multimodal social semiotics it is perhaps feasible to consider non-verbal fragments to be greater than ten seconds. A somewhat different approach to video-based research proposed longer episodes of up to five-minute video clips (Davidsen and Vanderline, 2014). This meant that the longer duration of episodes was more suited to ethnographical frameworks (Heath et al., 2010) rather than one of multimodal social semiotics, as different kinds of information were sought. Similar to Heath et al. (2010), researchers using a multimodal social semiotic framework that utilised video-based data described varying lengths as bite-size chunks with no reference to time (Jewitt, 2011) and up to three minutes (Cowan, 2014).

An altogether different selection criterion for an episode or compositional phase is described in music-related research where varying limitations for implementing these within my study arise. Research focusing on time analysis attended to the percentage of time spent for each compositional phase rather than the length of that phase (Kratus, 1989; Seddon, 2001; Fautley, 2005; Biasutti, 2012). This means that the selection criteria focused more on the frequency of individual phases that made up the whole compositional process. For example, pupils in Kratus' (1989) study were restricted to a time limit of ten minutes to compose something. Imposing a compositional time limit would not be consistent with multimodal social semiotic theory and was therefore not employed.

Three music-based studies that did report an episode's length are Seddon (2001), Fautley (2005) and Mellor (2008). However, their episode selection criteria are equally unsuitable for my study. Seddon (2001) and Mellor (2008) classified periods of silence as lasting for more than five seconds, and only when mouse movement ceased. This criterion is problematic as the lack of mouse movement suggests no other non-verbal

communication or action occurred. Contrastingly, Fautley (2005) concluded that episodes varied in length from six seconds to longer than two minutes. However, these episodes examined pupils' interactions that also included speech. Similarly, Dobson (2020) selected episodes, of varying and unspecified lengths, which reflected different technology-based themes and were identified by the pupils' talk.

Concepts of the researcher's interests, framing of the instances and specificity in identifying particular events or phenomena in order to locate instances were considered relevant for my study (Heath et al., 2010; Bezemer and Mavers, 2011; Bezemer and Kress, 2016). Taken together, the literature informed my decision to seek instances of non-verbal communication greater than ten seconds with no upper limit (Heath et al., 2010). The following section details the principles of multimodal transcription (Bezemer and Mavers, 2011) which guided my study's transcription design and outlines methodological decisions as they were encountered.

4.6.2 Principles of Transcription

My interest in the pupils' episodes, absent of speech, shapes the reflection on the 'aptness' of representations they make during these instances of non-verbal communication. An illustration of what may be considered 'apt', could be one pupil's action of playing a MIDI keyboard in a way suggestive of creating a melody, whereas another pupil may use the mouse to input and create a melody. A multimodal social semiotic framework views transcripts as artefacts, empirical material constructed through a social meaning-making practice (Bezemer and Mavers, 2011, p.193). As such, it is assumed that transcription is semiotic work (Kress, 2010) that facilitates the recognition of a multiplicity of modes, and their resources, thus creating 'inroads into learning' (Bezemer and Kress, 2016, p.3).

4.7 Trustworthiness

This study draws on the conventions of a multimodal social semiotic theoretical framework that advocates hypothetical truths (Bezemer and Kress, 2016; Jewitt et al., 2016) or confidence in the truth of findings (Low and Pandya, 2019). As such, the theory

presupposes that transcription is a social practice (Bezemer and Mavers, 2011). In this study, the transcripts, or mappings, are not only empirical materials but semiotic work (Kress, 2010). Guided by the multimodal transcription work of Bezemer and Mavers (2011) and applying the principles of recontextualization (Bezemer and Kress, 2016), it offers a robust and verifiable framework. That means modality is not about the actual truth or falsity of representation, but whether an interpretation is represented truthfully, or not (Kress and van Leeuwen, 1996; Ravelli and van Leeuwen, 2018). The interpretations are hypothetically understood as being real where the material reality of the sign is always analysed (Kress, 2010). An alternative view would consider the use of video as a transformation of the pupils' computer-based compositional experiences rather than an objective representation (Jordan and Henderson, 1995, p.53).

This is comparable with literature on qualitative conventions of validity seeking a resolution of, 'how accurately the account represents participants' realities of the social phenomena' (Creswell and Miller, 2000, pp.124-125). The perspective further differs from the positivist conventions of quantitative research that address matters of validity and reliability (Lincoln and Guba, 1985; Denscombe, 2014).

4.7.1 Building Rapport and Establishing Familiarisation with Research Equipment

Establishing a rapport and familiarisation with Camtasia with both participants was an essential step towards developing trustworthiness of the study's methodology (Patton, 2015). Two aims were identified at the planning stage. The first aim considered participant behaviour and their ability to act naturally when being videoed. The second aim contemplated data collection and how best to ensure this study's methodological approach encapsulated the participants' reality.

These two concerns further considered unobtrusive measures or non-invasive methods used to collect data in the research environment whilst maintaining a natural and unchanged setting as possible (see Section 4.4). This meant using methods that would not distract the two participants (or other pupils in the class) from their work whilst being reflexive of my position as a non-participant researcher.

Using the computers in the participants' music classroom, in their school environment and in the same manner that Alex and Ollie were accustomed to, aimed to reduce any potential concerns pertaining to the natural setting. Installing Camtasia onto one music classroom computer and utilising the computer's built-in camera supported this measure (Section 4.4). However, what was questionable was how intrusive the use of a separate small camera would be (functioning as a video) positioned to the left-hand side of the computer. Recognition that one small object may be a minor distraction determined provision for the participants to familiarise themselves with the equipment and methods, prior to the collection of data, which served to:

- minimise and negate any problems;
- allow the participants to familiarise themselves with the equipment;
- allow participants to raise questions and receive answers about the equipment or methods; and
- review the methods, especially if one becomes noticeably problematic during the observation process.

Furthermore, it may be common classroom practice for pupils to be recorded in musical performances and this study acknowledged the act of recording may result in the pupils' altered behaviours. Ensuring participants felt comfortable and were able to act naturally when being videoed was required to establish trustworthiness, as well as satisfying ethical considerations (see Section 4.9).

Prior to observation, the participants spent two lessons working and familiarising themselves with the equipment. In conversation with Alex and Ollie, they commented that the video set up was unobtrusive by stating 'they had forgotten they were being recorded', thereby indicating comfortableness with the equipment (Cohen et al., 2018). Alex and Ollie asked two questions: What happened to the recordings afterwards and could they watch the recording? In response, the participants were shown the Camtasia footage and how the recording would be removed from the system and stored on a password protected external drive. The participants further questioned the mechanics and value of the recording whilst they continued to laugh and comment on their appearance and actions. The pupil's inquisitiveness provided me with a good

opportunity to build a relationship with them by answering their questions, discussing the research process and addressing how the data would then be generated and used from the video footage (Patton, 2015).

4.8 Researcher's Reflexivity

The main purpose of this section is to attend to my reflexivity in the research process and is in addition to the researcher's journal I kept (Section 4.4.5). Reflexivity is taken as a vital component in qualitative research (Berger, 2015) where Holmes (2020, p.2) elaborates that the researcher is involved in 'an ongoing process of being able to identify, construct, critique, and articulate their positionality'. My positionality in the research process was detailed in Section 4.2 where I outlined my theoretical, ontological and epistemological positions. Here, I will reflect upon those and illustrate my continuing awareness of challenges and opportunities that emerged.

From the beginning, this study necessitated a move beyond my experiences in professional practice as a former music teacher to an alternative research environment that would allow me to maintain research objectivity and develop as a researcher (Yarbrough, 1996; Burnard, 2002; Denscombe, 2014; Kratus, 2019). This transition was an opportunity to develop as a researcher, learn new skills and be open-minded that not all music practices are the same. However, this perspective also presented challenges as I was conscious that my former role as a music teacher came with its own historical background, and musical knowledge (Bruner, 1990).

In my journal, I frequently posed 'what if' questions related to my presence in the classroom and the potential effect that may have on data collection. One example is, what if other pupils in the classroom treated me as a teacher? These concerns were addressed by having good ethical practice, e.g. addressing potential benefits and risks to the teacher, teaching assistant (if applicable), other pupils and the two participants as well as maintaining appropriate researcher relationships.

Reflexivity in Framing and Generating the Data

During this phase of the research process, I began to question who I was to reconstruct, interpret and assign meaning to someone else's compositional experiences? This process was about giving recognition to the pupils' instances of non-verbal ('silent') communication and their experiences of composing through their choices of modes and resources of modes. It was not about whether I thought the pupils were right or wrong. I also anticipated that the pupils may not follow the teacher's pedagogical framing.

In the second stage of mapping (Section 4.5.2), I acknowledged that the pupils' original interactions shifted from one form of representation (video) to another (map), and it was my responsibility to reproduce a transcript that was representative of their social meaning-making practices (Bezemer and Mavers, 2011). Applying the principles of recontextualization (Bezemer and Kress, 2016; Section 4.5.3) was consistent with multimodal social semiotic theory in that I was able to re-shape the pupils' semiotic work, interactions and interpret their process of meaning-making. This process of re-shaping was important in establishing the pupils' design for learning but equally prudent to acknowledge it was a hypothetical recovery of the pupils' meanings.

The decisions I made in framing, selecting, arranging, and foregrounding present a somewhat different perspective on 'reality' (Erickson, 2006). However, these representational choices were consistent with multimodal social semiotic theory, making the process explicit. It shows how meaning was constructed, acknowledging the inherent subjectivity of the researcher and further recognises the need for *other users* to understand the analytical outcomes.

Reflecting on the Positionality of my Participants

The analytical process includes screenshots, mappings and pictures of my two participants. In my research journal, I wrote the phrase, '*fair treatment, purpose and respect for the two pupils*'. Although I did not formulate specific questions, I was mindful of the images being used and the significance that screenshots had in my analytical framework. Many of these concerns are addressed in the ethical considerations

(Section 4.9). Multimodal social semiotics suggest that communication happens as a response to a prompt (Kress, 2010). In the context of a traditional thesis aside from observing good ethical practice and applying the theoretical framework, how else is non-verbal communication evidenced? Social semiotic literature depicts one possible solution: the use of hand-drawn images (Mavers, 2009; Bezemer and Kress, 2016).

4.9 Ethical Considerations

This section addresses this study's ethical considerations from the perspective of practice, theory and legal requirements.

4.9.1 Negotiating Access

Negotiating access occurred on two separate levels: the host school and the music department within the school. The first access meeting was with the school's Head and the Head of Music, where we deliberated on the research focus and aims as outlined on the information sheet. The school broached two queries: whether the study could collect data about whether working in pairs hindered pupil progress and why the research focus was 'silence' and not speech. Although pupil progression was not the focus, this is an ongoing and purposeful area of deliberation. Through discussion, the research focus was reiterated and formalised, and written consent was agreed for this study to proceed.

The second meeting with the school's music department involved the departmental head and the music teacher. It was at this stage that voluntary written consent from the two music teachers was sought. The meeting further negotiated and formalised a more detailed action plan that became the research schedule. The proposal accounted for the time needed to establish the following research activities:

- meeting with potential participants and introducing the project;
- gaining informed consents;
- building a rapport with participants;

- time for participants to familiarise themselves with the research equipment and with researcher observation (including Camtasia);
- observation times; and
- debriefing sessions.

4.9.2 Informed Consent

All potential pupil participants received a short presentation about the study where interested pupils were provided with information sheets and invited to ask further questions. Having established willing volunteers, parental and guardian information and informed consent forms were distributed as well as informed consent forms for the pupils. Pupils were asked to discuss their possible participation in the study with their family unit before making a decision and were given contact details should they have additional queries. Participant selection was by return of parental, and their consent forms.

Designing the consent forms took into account a comprehensive checklist of ethical issues (Patton, 2015, pp.496-497) which incorporated the following:

- methods being used to gather data;
- reciprocity matters;
- outline of any potential risk or harm;
- confidentiality and aspects where full anonymity could not be guaranteed;
- voluntary informed consent and the right to withdraw; and
- data protection and access, as well as who held the ownership of data.

Three versions of the information sheet and consent form were created that catered for Year 9 pupils, their parents and the Host School. The wording and content of each accompanying information sheet differed depending on its audience. This was particularly evident when outlining reciprocity matters. Here, the school was gifted with the Camtasia package with a year's educational licence whereas the pupils were to gain an enriching opportunity. The opportunity anticipated that the recordings of the pupils' semiotic work would enable the pupils to share their designs for learning.

The pupils were consenting to voluntary participation in this study's research with the right to withdraw at any time, without giving a reason, and without consequence. The information sheets detailed how recorded data was being collected for purposes of research, analysis and publications.

The pupils further agreed to:

- being observed composing and/or working on a task in four separate but sequential, music lessons by the researcher;
- the researcher taking notes of the pupils' actions and interactions;
- the computer records their music, talk and the work in progress as well as eye movements, interactions and gazes;
- the handheld camera to be situated on the desk recording hand movements and actions on the keyboards and mouse;
- the possibility of minimal distraction in learning due to recordings and observation;
- the use of anonymised quotes; and
- a possibility of them becoming identifiable through the data collection methods (i.e. recording), although the researcher's procedures minimised this point as much as possible. (Taken from Pupil Participation Information Sheet and Consent Form)

In accordance with BERA's ethical guidelines (2011), informed consent further contained a section regarding the use of images, screenshots, short video clips and audio/musical recordings that contained personal data. Under Bath Spa University's ethics policy (2014) these aspects of capturing, protection, dissemination and disposal of digital technology data were rigorously examined. This process was governed through questioning and additional correspondence that indicated my ethical understanding of such materials before approval was confirmed.

4.9.3 Ongoing Verbal Consent

Ongoing voluntary verbal consent was obtained from the participants and music teacher prior to any, and all, data collection stages (BERA, 2011, 2018; Creswell, 2014). Before observation, pupils were individually briefed about the video data and field notes being collected, ongoing consent was obtained, and pupils were thanked for sharing their musical experiences.

During the lesson observations (up to and including 7 February 2017), all participants were afforded the right to withdraw, at any time, without reason or consequence (BERA, 2011, 2018). This matter was subsequently addressed in parental and teacher information as the pupils were under the age of 16. The information specified circumstances pertaining to the participants' well-being and safeguarding matters or concerns in maintaining their academic attainment. If necessary, the teacher's recommendation would guide the participants' withdrawal (BERA, 2011, 2018). Any withdrawal would have automatically resulted in the destruction of the data collected, to maintain data protection and confidentiality (Data Protection Act, 1988; Creswell, 2014).

4.9.4 Participant Anonymity

There were particular concerns about participant anonymity arising from the decision to use Camtasia software for data collection. Due to the centrality of multimodal interaction and non-verbal communication, this study could not guarantee full anonymity in publications. If, for example, facial expressions illuminate a finding then pixelating the image would mean that the point could not be made visually with the use of video stills or screenshots. Obscuring facial images removes the possibility of reader validation and would reduce the impact of the research findings and interpretations. Thereby, providing properly informed consent was central to addressing 'participants being identifiable by their facial image alone'. Furthermore, BERA (2011, Section 25, p. 7) and Handbook on Research Integrity and Ethics (Bath Spa University, 2014) recommended that information sheets detail the concern and in line with BERA requirements participants, and their parents, were asked to waive their rights to full

anonymity (Creswell, 2014). Consequently, the following clause was added to the pupils' and parents' information sheet and consent form:

'It is my intention to publish findings in journals and conference papers. This may include screen shots [sic] or image stills taken from the computer recording and/or video extracts which may identify your child from their facial image alone, but their name and the schools [sic] name will not be associated with it.'

4.9.5 Keeping the School Anonymous

The school was afforded anonymity throughout the ethical consideration process. However, a caveat in the permissions meant that due to the use of Camtasia, the school may become identifiable through the pupils' uniforms. This was minimised through pixelating and/or blurring any school uniform identification marks and by using a pseudonym for the school. Equally, it was recognised that the Camtasia footage may identify the music teacher which may subsequently make the school identifiable. These small risks were discussed in all meetings with the school prior to the commencement of the research. The participants, parents, music teachers and the Head Teacher permitted the video clips and images to be made available as part of academic publications.

4.9.6 Project Approval

I confirm that this study was approved by Bath Spa University Ethical Committee on 13 July 2016.

4.9.7 Data Protection

The study followed the Data Protection Act (1998), as required at the time of research. Installation of Camtasia onto one music classroom computer was approved during the first research meeting with the Host School and is reflected in the signed consent form. As a part of the post-observation procedure practical steps were taken to extract Camtasia footage to an external hard drive with password protection. The process involved removing the data from the school's system and ensuring other interested

parties (i.e. music teachers) had minimal, or no access to the complete footage (Derry et al., 2010). However, as already mentioned, full anonymity could not be guaranteed. The nature of digitally videoing pupils during a school music lesson in the context of their natural setting implied the pupils were wearing school uniforms. Where possible, the school emblem visible on the jacket had the potential to identify the exact school.

4.9.8 Debriefing Sessions

At the end of the research process, there were two debriefing sessions. The first was for the two pupil participants and the second was for the two staff members of the music department. The debriefing sessions aimed to thank the participants, reiterate the purpose of the research and answer any questions relating to the research conducted (Denscombe, 2014). In addition, the content of each debriefing session covered matters pertaining to anonymity and data protection were also addressed. The music department received slightly more information detailing the Camtasia licensing information and the next steps of analysis.

A research report was forwarded to the Host School in May 2017 and detailed this study's preliminary findings. The report recapped: the research focus and methods, outlined an overview of the initial findings with a brief discussion, a summary of other initial findings and a recommendation. The initial findings focused on the computer mouse, its functions within the context of computer-based music composition and for what the pupils used it.

4.10 Chapter Summary

This chapter has detailed the multimodal social semiotic principles and processes undertaken in my study. It draws together multimodal social semiotic theory for communication and meaning-making in order to recognise and analyse the significance of the pupils' signs of learning during different compositional activities. Chapter Five is the recontextualization (Bezemer and Kress, 2016) of those original events as they are re-made into an analytical account for this thesis.

5.0 Chapter Five: Findings: Analysis and Interpretations of Sixteen Instances of Non-Verbal Communication

5.1 Introduction

In this chapter, the analytical framework will be used to examine, interpret and present findings from four computer-based compositional music lessons. The chapter begins with a brief introduction of how the data corpus is presented for analysis. Next, two subsections provide contextual information to orientate the reader to the Key Stage 3 pupils' positioning at the computer workstation (Section 5.1.1) and outline their compositional task (Section 5.1.2).

The chapter is organised into four distinct sections each representing one of the four lessons. Within each lesson, I have selected four instances of non-verbal communication with each of these having a different preceding modal prompt. These episodes were selected by the processes explained in Chapter Four where I generated and framed the data (see Section 4.5). Of these four instances of non-verbal communication one episode will always be prompted by the mode of speech. These utterances are identified by the use of italics encapsulated by brackets: for example, (*hold on*). The preceding modal prompt consists of a number of modal configurations: speech, sound, gaze, movement, gesture, facial expressions and action encompassing engagement with resources. Each prompt is framed from two to three seconds preceding the absence in pupils' speech. The identified preceding modal prompt is outlined in bold font and highlighted in grey at the top of the episode's transcription. In each instance, at least one mode is prominent within the ensemble of modes in what I have framed as a prompt.

Each lesson opens with contextual information that locates the pupils' design for learning in its wider contextual and institutional framing (Bezemer and Kress, 2016; Jewitt et al., 2016). Next, contextual information may refer to the teacher's pedagogical framing. This contextual information draws on features in the Scheme of Work (Appendix A) and to the specific instructions given to the pupils that represents the

teacher's most immediate prompt before the instance of non-verbal communication. Then, the four selected episodes of non-verbal communication are presented.

Each episode presents a mapping of resources available for non-verbal communication. Each mapping represents the pupils' modes and resources of modes, and the transcript provides temporal frames of the episode, in seconds; for example, 02:05 seconds represents 2 minutes and 5 seconds. Each second contains two visual representations from Camtasia, one captured from the integrated computer camera and the other from a separate side camera. In the mapping, there is a description of the modes, and resources of modes that accompany each frame. Following the mapping, the visual representation of the computer screen shows two screenshots of each episode's first and last frames, taken from the computer software interface, GarageBand. These screenshots are accompanied with a brief analysis of this crystallisation of the pupils' semiotic work, which forms part of the discussion in Chapter Six. Lastly, having transposed the originating data from Camtasia to the transcript, I continue to use the principles of recontextualization (Bezemer and Kress, 2016) to reshape the meanings of the pupils' unfolding non-verbal interactions. This means that I present another layer of analysis and the interpretations that I have made. In the analysis, when comments refer to the pupils' headphones as being on, I am often making the assumption that they are listening to computer-generated sounds. Table 5.1 summarises the organisation and formatting of each lesson and episode.

Table 5.1: Summary of the lessons' analytical organisation and format

Each Lesson A contextual overview of the lesson includes the teachers' pedagogical framing and four distinct subsections. Each subsection represents an episode (also known as an instance of non-verbal communication).
Each Episode Information is provided on the overall context and its positioning within the framing of the whole lesson with a mapping of resources available for communication. This is followed by screenshots of the episode's first and last frames as well as my interpretations of the data.

5.1.1 Different Camera Angles on the Pupils' Seating Positions

Figure 5.1 aims to orientate the reader with the different camera views as provided by Camtasia, the small camera and the seating positions of the participants. The integrated camera shows Ollie's seating position on the left of the frame, whereas the side camera captured his positioning towards the top of the frame (indicated by the red arrow). The opposite is true for Alex. He was always positioned on the right-hand side of the frame on the integrated camera view and, as shown in the side camera, by the red arrow at the bottom of the frame.

It is worth noting that in this study, the pupils always sat in these positions. Here, the concept of spatial awareness often becomes ignored by the demands of pupils' interaction and engagement (Breeze, 2011; Haviland, 2011). The crossover of action, i.e. pupils' arms crossing each other when reaching for the mouse and keyboards, provided extra challenges in the analytical process, especially when the pupils were out of frame.

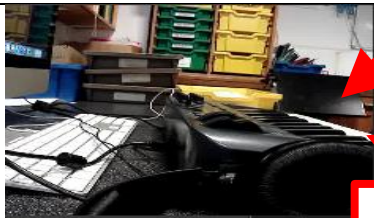
Time	Integrated Webcam	Side Camera	Ollie's Seating Position
01:55			Alex's Seating Position
	Ollie Alex		

Figure 5.1: Camera orientation of the participants' seating positions

5.1.2 The Computer-based Compositional Task

The school's music department planned a computer-based compositional task to span six weeks, with each lesson lasting 55 minutes. Pupils were asked to compose three leitmotifs for three main characters for a 40-second segment of The Snowman episode from the BBC Dr Who series (2012). The characters were the Doctor, Clara and the Ice Governess. Pupils first notated their leitmotifs and chosen key signature on manuscript

paper prior to using the Mac computers with GarageBand software to create their compositions. The task extended to include developing leitmotifs, composing a soundtrack, adding chords and movie markers. Movie markers were identified as transition moments between the music and a specific part of a scene, or vice versa depending on the intended effect of the music. The teacher's pedagogical framing incorporated three forms of assessment (formative, summative and peer evaluation) throughout the six-weeks.

5.2 Lesson One - The Beginning

Lesson Context

It was the second lesson on a Tuesday morning and pupils lined up for their first music lesson of the New Year. The classroom was an open, airy space, with pupils seated in a horseshoe pattern guided by the workstations and benches around the periphery. The teacher began the new topic with the theme music for 'The Apprentice' (BBC One), followed by the history of opera: Wagner, leitmotifs and how composers like John Williams have adapted this musical device for their film music. Next, was the theme music for Star Wars, where the characters were identified in the emerging sounds. Prokofiev followed this . . . *Peter and the Wolf* . . . an example of programmatic writing where the characters can be identified by their specific musical motif, like the two alternating low-pitched notes (E - F) used in the *Jaws* (1975) movie signifying impending doom. After 40-minutes of the teacher's input, the lesson's objective indicated that the pupils were to begin to compose their motifs for the three characters using keyboards and/or GarageBand as a score function (Appendix A).

The four episodes draw on different phases within the 11 minutes pupils were given to complete the task. The dominant phase of this lesson mostly corresponds to the teacher's framing of notating the scale and/or key signature along with the chords and/or triads for: A Aeolian also known as A to A, or A minor or C major.

5.2.1 Episode One

The preceding modal prompt was the teacher's verbal instructions, '*remember I want to see what scale you're going for,*' as the pupils set up the computer workstation for the new compositional task. The teacher's instructions clearly aligned with the first aspect of the pedagogical framing, *to choose a scale and create three leitmotifs* (Appendix A) and appeared to be a compulsory and preliminary compositional decision for the pupils to make. Sitting side by side at the computer, Ollie set up GarageBand by adding a track, selected the grand piano sound and started to play the keyboard. Alex then positioned himself away from the desk, sitting behind Ollie, and suggested that they, '*need a bass line or something to start off with.*' Alex then carried on searching in a bag.

Mapping of resources available for communication.

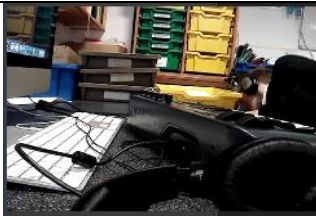
Preceding Modal Prompt [Lesson 1 Episode 1]

Teacher's verbal instructions: (*remember I want to see what scale you're going for*) repeated twice

Alex movement and speech: (*we need a bass or something to start off*) (*so basically*)

Ollie pointing mouse; action keyboard

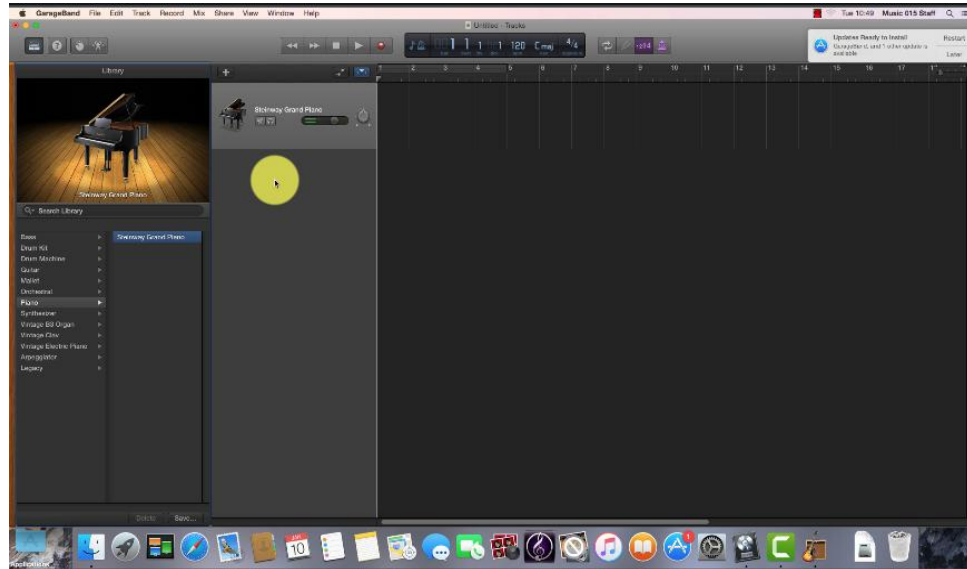
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer - generated Sound
01:55				Alex's hands remove pencil case from bag	Ollie gaze left at partner pencil case Alex eyes on pencil case		Alex sat back Ollie sat forward close to keyboard	Ollie headphones on, no sound
01:56			Ollie right hand on mouse	Alex lowers pencil case	Ollie looking downwards Alex looking at monitor			Ollie headphones on, no sound

01:57			Ollie moves right hand from mouse to keyboard	Alex opens pencil case	Ollie looks towards right hand on keyboard Alex looking in pencil case			Ollie headphones on
01:58				Alex reaches into pencil case			Ollie bends right towards the floor Alex's head rises	Ollie headphones on
01:59				Alex removes a pen			Ollie still bending	Ollie headphones on
02:00			worksheet on desk by Ollie		eyes gazed down both pupils		Ollie body moves in front of Alex	Ollie headphones on

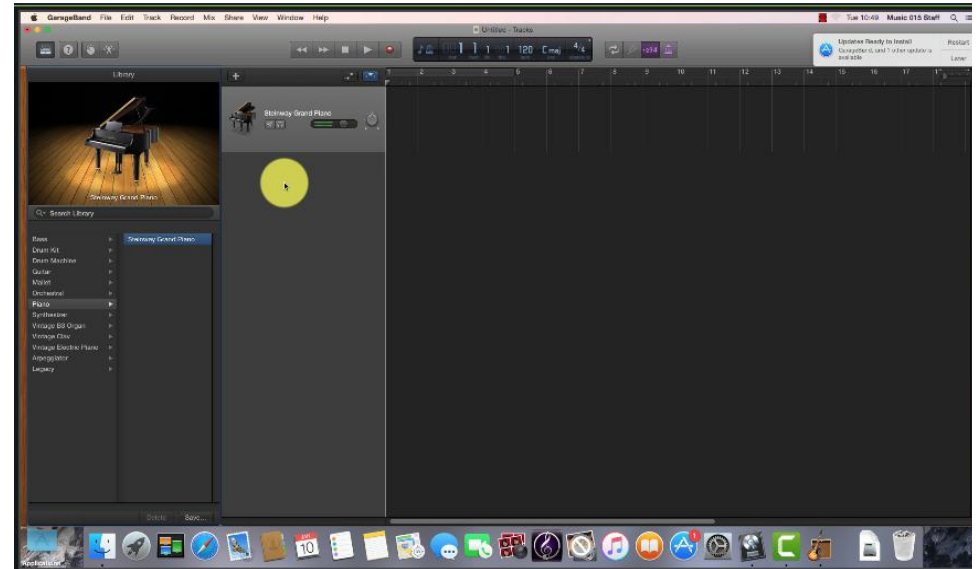
02:01			Ollie plays keyboard	Alex placing pencil case in bag	Ollie gaze on hand movement on keyboard Alex gazes in bag		Ollie body in front of Alex Alex sits back further in seat	Ollie headphones on, keyboard sound low pitch
02:02			Ollie continues to play keyboard	Alex closing bag	Ollie gaze on hand movement on keyboard Alex gazes in bag		Alex's shoulder and head position further back	Ollie headphones on, keyboard sound low pitch
02:03	Photo removed in this version		Ollie continues to play keyboard		Ollie gaze on hand movement on keyboard Alex gazes at bag		Alex's arm movement closing bag; body moves backwards	Ollie headphones on, keyboard sound low pitch

02:04			Ollie continues to play keyboard		Ollie gaze on hand movement on keyboard Alex gazes at bag		Alex's arm movement - moving bag	Ollie headphones on, keyboard sound low pitch
02:05			Ollie continues to play keyboard		Ollie gaze on hand movement on keyboard Alex looks at Ollie's hand movement		Ollie moves to upright position Alex moves forward in chair to sit beside Ollie	Ollie headphones on, keyboard sound low pitch
02:06			Ollie continues to play keyboard		Ollie gaze on hand movement on keyboard		Alex bends forwards under desk	Ollie headphones on, keyboard sound low pitch
02:06 end frame			Ollie continues to play keyboard				Alex moves upwards	Alex speech.

Screenshots for Episode One



01:55 Screenshots of the episode's first frame



02:06 Screenshots of the episode's end frame

There are no visible changes between the beginning and end frames from this instance of non-verbal communication. This is problematic for the teacher as just viewing the screen gives no insight into what had taken place. There is the possibility that no composition or learning took place as the screenshots show no change. However, multimodal social semiotic theory assumes learning occurs when learners engage and respond to their social world (Kress, 2010; Section 3.4), suggesting learning, composition and communication occurred somewhere other than on the computer. Each subsequent episode will unpack non-verbal communication and action that occurred in between these frames.

Interpretation of Episode One

The analysis of the 11 second episode indicated that Ollie was engaged in learning. He was observed sitting back and gazing at his partner before the transformation of resources at 02:00 where he started to play the keyboard. The second transformation of resources came at 02:05 in which Alex finalised his search for writing materials, signalling to Ollie that he was now ready to engage in the composition.



Figure 5.2: Screenshot taken from Lesson One at 02:01 – pupils' different resources of the modes of action and gaze

Figure 5.2 exemplifies both pupils' engagement as sign makers, each interested in their own resources of modes for action and gaze. Although the resources of those modes communicate different meanings, they were both explicitly aware of each other's intentions. Ollie attended to Alex's verbal suggestion rather than the teacher's, whereby he simultaneously played the keyboard in a low pitched tone as he closely watched his hand movements (02:01 - 02:06). With the headphones on, it indicated he also listened to what he played. Thereby, the dominant modes enacted by Ollie were body positioning, gaze and action, all suggesting he was trying out a bass line idea for the composition. This interaction lasted for seven seconds. At 02:05, a transformation occurred where Ollie's body positioning moved from angled to upright. The significance of this transformation invited Alex to re-join the activity which coincided with Alex's pre-empted gaze towards Ollie's keyboard playing.

Alex's own repositioning, as he drew his chair closer to the keyboard and placed his bag under the desk, was a prompt for Ollie to stop playing (02:05). This further signified that

Alex was perhaps trying to organise writing tools to complement the teacher's verbal instructions between 01:55 to 02:04. The episode concluded with Alex asking Ollie if he had a bass line. Notably, Alex was not wearing headphones. Therefore, the meaning of what Ollie had played was perhaps lost as Alex only glanced across once. Had Alex been wearing headphones, then a different interpretation of his partner's actions may be available.

Between 02:01 to 02:06, Ollie's body and hands positioning on the keyboard indicated that he was playing something using the lower-pitched notes. Beyond the mapping of resources available for communication, I considered the mode of sound from the original Camtasia recording. In the five-second interval (02:01 to 02:06), Ollie played three notes which sounded feasible enough to be something for a bass line.

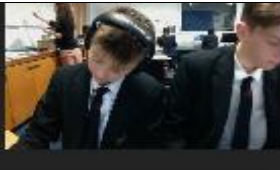
From the multimodal perspective of learning, the pupils' interest, or at the very least Alex's, rested with finding a bass line. Ollie responded to his partner's suggestion and engaged different resources (keyboard, positioning and gaze) in an attempt to compose a bass line, albeit three notes in five seconds. Interestingly, neither pupil followed the teacher's preceding modal prompt, although Alex's gesture and directional gaze suggested he at least intended to start choosing a scale once he had the correct resource (i.e. a pen).

The mapping of resources for communication showed the pupils had alternative ideas on their compositional starting point which was perhaps formed from prior musical experiences. The short bass line was not recorded during the episode and thereby not crystallised, which is consistent with the episode's framing of the two screenshots. However, Ollie's actions showed that his meaning-making was shaped by the resources he chose in playing the keyboard. He understood the keyboard layout and positioned himself accordingly and engaged in some form of composition. Thereby, Ollie's design for learning was prompted briefly by his partner's suggestion, and this became visible in the five second interval discussed.

5.2.2 Episode Two

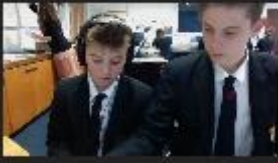
In the 32 seconds between Episodes One and Two, Alex and Ollie alternated between trying out and listening to the scale's options on the keyboard, A to A and C to C, and agreed on A to A. The episode was chosen as Alex and Ollie were observed writing something down and intermittently playing the keyboard, yet neither of them used the computer. Alex appeared focused and determined to complete the task as he alternated from writing to playing, to just writing and then looked away from his workstation. The consistent movement from Alex perhaps illustrated his musical knowledge or motivation, but it could have signified anxiety in getting the correct information down on the sheet. Ollie, however, apparently took a little longer to approach the task: writing, sitting back and then playing the keyboard.

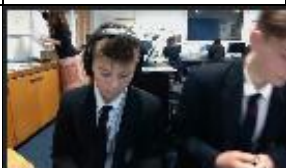
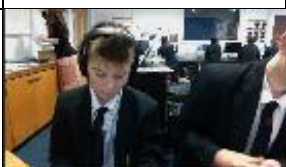
Mapping of resources available for communication

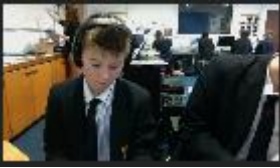
Preceding Modal Prompt [Lesson 1 Episode 2]								
Alex notation Ollie gaze; notating on worksheet and speech (<i>key A to A</i>)								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
02:41 (11)			Ollie and Alex notating		Both look downwards at worksheets		Ollie head tilted left Alex sat upright	Ollie headphones on, no sound
02:42			Ollie and Alex notating		Both look downwards at worksheets		Alex bends head closer to desk	Ollie headphones on, no sound

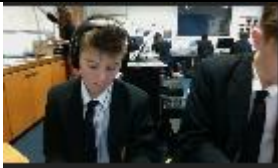
02:43		Ollie and Alex notating		Both look downwards at worksheets		Alex bends head further to left	Ollie headphones on, no sound
02:44		Ollie and Alex notating		Both look downwards at worksheets		Alex straightening head position	Ollie headphones on, no sound
02:45		Ollie notating	Alex clasped his hands together	Ollie continues looking at worksheet Alex looks at Keyboard	Alex thinking	Alex leans towards the keyboard in upright position	Ollie headphones on, no sound
02:46		Ollie stops notating Alex playing keyboard	Ollie clasps hand together with pen Alex with right hand on keyboard	Alex continues looking at keyboard Ollie glances left at Alex's hand movement		Alex extends arm Ollie lifts head facing left	Ollie headphones on, keyboard sound - scale playing ascending Alex no headphones

02:47			Alex playing keyboard		Alex continues to watch his hands playing on the keyboard Ollie continues to look at partner's hand movements	Ollie considering partner's actions	Ollie sits upright and further back in seat	Ollie headphones on, keyboard sound - scale playing ascending Alex no headphones
02:48			Alex playing keyboard		Alex continues to watch his hands playing on the keyboard Ollie continues to look at partner's hand movements			Ollie headphones on, keyboard sound - scale playing ascending Alex no headphones
02:49			Alex playing keyboard		Alex continues to watch his hands playing on the keyboard Ollie continues to look at partner's hand movements			Ollie headphones on, keyboard sound - scale playing ascending Alex no headphones

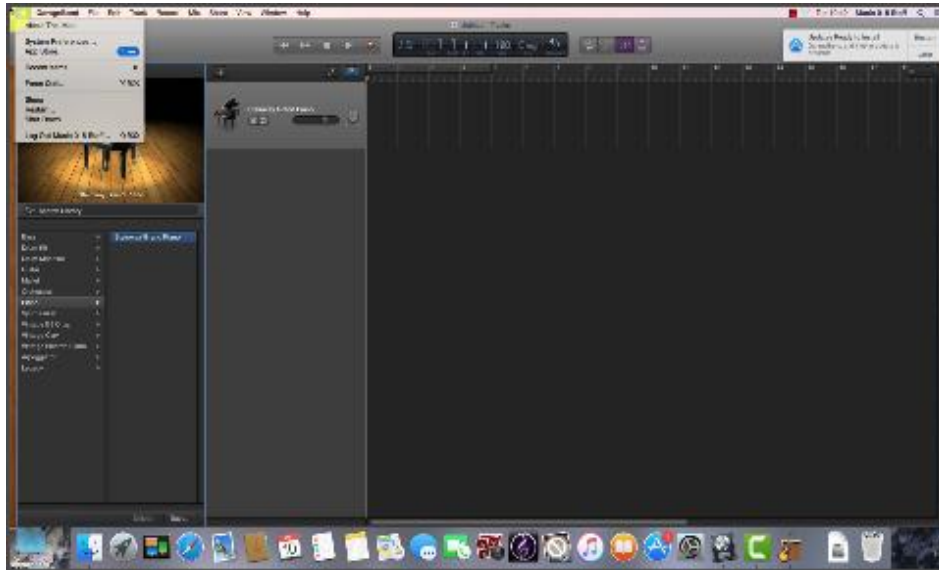
02:50			Alex playing keyboard		Alex continues to watch his hands playing on the keyboard Ollie continues to look at partner's hand movements			Ollie headphones on, keyboard sound - scale playing ascending Alex no headphones
02:51			Alex playing keyboard		Alex continues to watch his hands playing on the keyboard Ollie continues to look at partner's hand movements			Ollie headphones on, keyboard sound - scale playing descending Alex no headphones
02:52			Alex playing keyboard		Alex continues to watch his hands playing on the keyboard Ollie continues to look at partner's hand movements			Ollie headphones on, keyboard sound - scale playing descending Alex no headphones

02:53			Alex playing keyboard		Alex eyes closed Ollie continues to look at partner's hand movements			Ollie headphones on, keyboard sound - scale playing descending Alex no headphones
02:54				Alex clasps hand together	Alex turns his head left to look at worksheet Ollie continues looking down but at the keyboard		Alex moves shoulders and head to the left towards worksheet	Ollie headphones on, no sound Alex no headphones
02:55			Ollie plays keyboard	Alex hands clasped	Alex gazes left at worksheet Ollie focuses gaze down at his own hands on keyboard		Alex moves shoulders and head further to the left and perhaps lowering towards worksheet	Ollie headphones on, sound

02:56			Ollie plays keyboard Alex notating		Alex continues to gaze left at worksheet Ollie continues looking downwards at own hands on keyboard		Alex head lowers further left towards worksheet	Ollie headphones on, sound
02:57			Ollie plays keyboard Alex notating		Alex continues to gaze left at worksheet Ollie gaze down at own hands on keyboard			Ollie headphones on, sound
02:58			Ollie plays keyboard Alex notating		Alex gaze left at worksheet Ollie continues looking downwards at own hands on keyboard			Ollie headphones on, sound
02:59			Ollie plays keyboard Alex notating		Alex gaze left at worksheet Ollie continues looking downwards at own hands on keyboard			Ollie headphones on, sound

03:00			Ollie plays keyboard Alex notating		Alex gaze left at worksheet Ollie continues looking downwards at own hands on keyboard		Alex begins straightening body to upright position	Ollie headphones on, sound
03:01			Ollie plays keyboard Alex notating		Ollie lifts his gaze and turns left towards partner			Ollie headphones on, sound
03:01 (29)			Alex stops notating Ollie playing keyboard		Ollie gaze lowers and remains left towards partner		Alex bends round towards teacher	Ollie headphones on, sound

Screenshots of Episode Two



02:41 Screenshots of the episode's first frame



03:02 Screenshots of the episode's end frame

There are no visible changes between the first and last frames from this instance of non-verbal communication. These two screenshots reiterate the problem that the teacher is not easily able to identify the pupils' signs of learning from the computer screen. Multimodal social semiotic theory suggests that meanings are established through the pupils' sign-making and the modes they choose to communicate with. We know that in between the two screenshots non-verbal communication is occurring. There is an apparent disconnection between the task and the tool (Pitts and Kwami, 2002; Cain, 2004; Wise et al., 2011; Himonides, 2012). The teacher's pedagogical framing of the task, with access to computers and its software, does

not match the pupils' choices of modes. Without examining the pupils' modes of communication in between these two frames, it is unclear what learning materialises.

Interpretation of Episode Two

The second episode of non-verbal communication lasted for the duration of 21 seconds.

There are four points to consider which highlight:

- transduction (remaking of meaning by a change in semiotic resources) for Alex between 02:45 to 02:53 and 02:56;
- transduction for Ollie from 02:46;
- materialisation of meaning for Ollie (02:55); and
- transformation of learning for Ollie at 02:55.

To begin with, the action of writing out the scale required the pupils to have familiarity with standard notation. Notating the scale introduced further modes such as images, letter names of the notes and words to identify the scale (Martin, 2014). The teacher's expectation was for pupils to use standard notation on their worksheet (Appendix C) which included the following modes and their resources:

Icons

- treble clef
- bar lines and double bar lines

Shapes

- circles representing the notes
- vertical straight lines representing the stem of the note
- five horizontal lines indicating the stave

Colours

- denoting the note duration as part of a circle (and either shaded in or not)

Indicated at 02:45, the frame illustrates Alex at the beginning of a transduction (using another mode to support meaning-making). Alex moved his body into an upright position, readjusting his downwards gaze from his worksheet on the left to the keyboard on his right. He then clasped his hands together signifying he had an idea or was contemplating what to play on the keyboard. It certainly signalled that he was getting ready to do something. Perhaps Alex's clasped hands is a sign of his decision on which

resources to best use to support his learning, such as keyboard, the mouse or the score function on GarageBand. This momentary pause prompted Ollie to stop notating and turn his attention towards Alex who simultaneously began to play the keyboard.

Across 02:46 and 02:47, the two frames show Ollie responded to Alex's sign through ceasing to notate. Ollie also changed the direction of his gaze which became focused on the positioning of Alex's hands on the keyboard. This transduction involved a shift in Ollie's semiotic resources of gaze and body positioning. Ollie sat back in his seat with an upright posture and focused on his partner's actions. The significance of this alters Ollie's meaning-making of the task and his positioning behind Alex perhaps emphasised co-operation, or at the very least acknowledged that Alex had control.

The duration of Alex playing the scale lasted for seven seconds. Ollie sat still, maintaining a focused gaze. The transcript showed Ollie was wearing headphones whereas Alex was not, and this would have implications for learning. For Ollie, the sound and visual of watching his partner helped materialise his understanding of the scale at 02:56. Materialisation of Alex's meaning occurred when he returned to notating the scale on the worksheet. The transduction, from worksheet to keyboard and back to worksheet, showed that the different orchestration of modes enabled some form of materialisation of meaning, inferring that the significance of playing the keyboard could have been to check the notes of the scale. Equally, it could be to check that his choice of notes sounded right or supported his notation skills. However, as Alex did not wear headphones, it is questionable just how much of what he played he actually heard, and whether this added anything to his learning experience.

During the final 12 seconds the pupils appeared to be working independently of each other, but in some respects, they co-designed their learning when signs of change became evident (i.e. transduction from notating the scale to playing the scale). There was a change in the dominant modes during this episode of non-verbal communication. Initially both pupils enacted the modes of action with a focused directional downwards gaze whilst notating on their worksheets. Alex remade meaning by choosing different semiotic resources (e.g. playing the keyboard and moving the direction of his gaze). This orchestration drew attention to his design for learning that helped him to materialise

meaning from the task. However, through the process of transduction and materialisation of meaning, Ollie seemed to be following the social cues Alex provided which enabled Ollie to replicate playing the scale.

5.2.3 Episode Seven

In between Episodes Two and Seven, the pupils had spent just under seven minutes deliberating the musical elements for their three leitmotifs. They had continued to notate the scale along with the chords whilst intermittently trying out ideas on the keyboard. With three minutes left until the end of the lesson, this instance of non-verbal communication demonstrated the first steps towards a new compositional idea for one of the character leitmotifs.

Mapping of resources available for communication.

The preceding modal prompt was complex in that the modes of action and sound were synchronous. Alex played a motif on the keyboard which Ollie heard through the headphones. Ollie's verbal response to the hearing of the sound signified to Alex that his idea was good, and he continued. This continuation during the instance of non-verbal communication ratified the prompt which theoretically confirms which mode(s) supported meaning-making to what is going on in the remainder of the episode.

Preceding Modal Prompt [Lesson 1 Episode 7] Alex action keyboard and speech (<i>Get it to go lower. This sort of thing</i>) Ollie gaze; sound and speech (<i>ah yess</i>)								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
10:07 (14)			Alex playing keyboard		Ollie gaze downwards at partner's hand Alex watching hand movement	Ollie mouth closing	Ollie sat on inwards slant Alex head tilted left	Ollie headphones on keyboard sounds 2 notes 5th interval

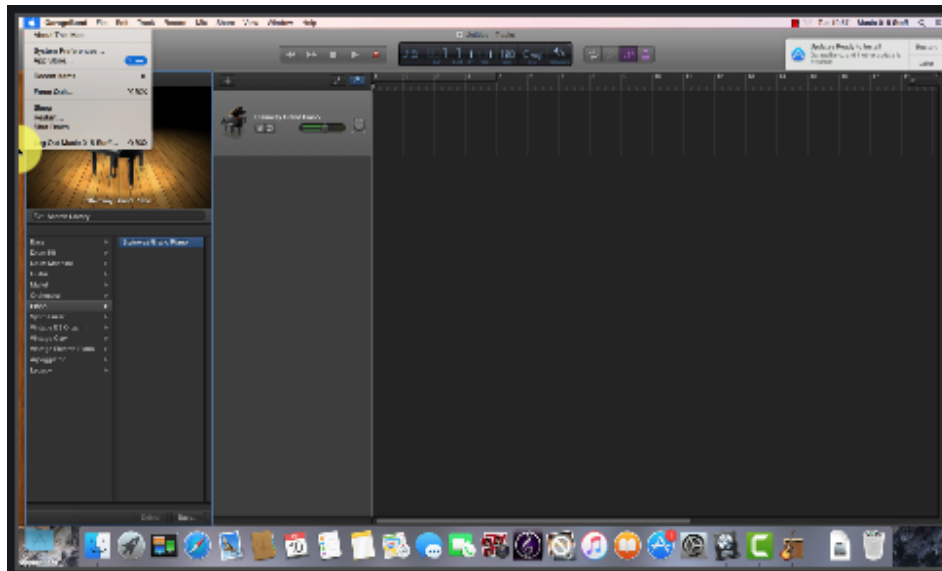
10:08			Alex playing keyboard		Ollie gaze downwards at partner's hand Alex watching hand movement		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on keyboard sound single note held
10:09			Alex playing keyboard		Ollie gaze left towards partner then downwards at partner's hand		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:10			Alex playing keyboard		Ollie gaze downwards at partner's hand		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:11			Alex playing keyboard		Ollie gaze upwards		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:12			Alex playing keyboard		Ollie gaze downwards at partner's hand		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on

10:13			Alex playing keyboard		Ollie gaze upwards		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:14			Alex playing keyboard		Ollie gaze downwards at partner's hand		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:15			Alex playing keyboard		Ollie gaze at partner's hand		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:16			Alex playing keyboard		Ollie gaze upwards		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on
10:17			Alex playing keyboard Ollie's left hand moves towards keyboard under Alex's hand		Ollie gaze downwards at partner's hand		Ollie sat on inwards slant Alex head tilted left	Ollie headphones on

10:18			Alex playing keyboard Ollie places left hand on keyboard under Alex's		Ollie gaze downwards at keyboard		Ollie sat on inwards slant Alex head tilted left Alex hand and wrist moves higher	Ollie headphones on, sound
10:19			Alex stops playing and removes hand from keyboard		Ollie gaze downwards at keyboard		Alex sits upright, hand moves closer to body Ollie moves body downwards towards keyboard	Ollie headphones on, sound
10:20			Alex removing hand from keyboard Ollie playing keyboard		Ollie gaze downwards at keyboard		Alex head and body tilts left Ollie positions head downwards closer to keyboard	Ollie headphones on, no sound

end 10:20 (17)			Ollie playing keyboard				Alex turns head towards Ollie Ollie moves downwards towards keyboard	Ollie headphones on, no sound

Screenshots of Episode Seven



10:07 Screenshot of the episode's first frame



10:20 Screenshot of the episode's end frame

Comparing the two screenshots it is visible that there are no changes between the beginning and end frames from this instance of non-verbal communication. From these screenshots alone, it is somewhat difficult to determine the pupils' designs for learning. We know from previous episodes that Alex and Ollie use worksheets for notation, and there is a possibility of more examples of transformations of resources to occurring between the two screenshots, which could evidence their signs of learning.

Interpretation of Episode Seven

The episode was 13 seconds long. My interpretation focuses on the preceding modal prompt and one transformation of resources between 10:17 and 10:19.

The preceding modal prompts of action and sound were synchronous and as the episode started Alex continued to develop the short motif. Of significance was the prominence of the sound heard by Ollie as it captured his interest and attention. Pitch is regarded as a linguistic and semiotic resource of sound (van Leeuwen, 1999; Machin, 2010) and would usually be analysed using multimodal discourse analysis, which is beyond the scope of this study. However, in specifying some form of representation of the sound, I include a basic melodic outline of the motif, which uses minor 3rds to portray sadness:

C - $\uparrow 5^{\text{th}}$ – repeated note - $\downarrow 5^{\text{th}}$ - $\uparrow \text{min } 3^{\text{rd}}$ - $\downarrow \text{min } 3^{\text{rd}}$

The starting note along with simple repeated interval patterns gives some indication to the musical understanding and knowledge that Alex possesses in creating a motif, thus contributing towards the composition.

Alex continued to play the keyboard for 12 seconds (10:07 to 10:18) whilst concurrently tilting his head to the left and focusing his gaze downwards on what he was playing. In the meantime, Ollie had turned his body inwards creating a closed triangular shape (Δ) between his partner and the desk. Ollie's gaze was focused and accompanied by the downward tilting of his head as he watched Alex's hands playing the keyboard. This was a sign of Ollie's full engagement and noted by his facial expression of a slightly opened mouth which signified some enthusiasm for what he heard.

At 10:17, Ollie slipped his hand underneath Alex's in an attempt to play the keyboard. In response, Alex lifted his hand and wrist higher to accommodate. What happened in the next two frames suggested that Ollie's action had in some way irritated Alex. We know this as the instances occurred in quick succession and in combination with a transformation of resources. Alex stopped playing, removed his hand from the keyboard and turned away from his partner. The different modes of facial expression,

the movement of his posture into an upright position and bringing his hands closer to his body indicated some form of momentary displeasure (10:19). However, at 10:20, Alex refocused his attention on Ollie playing the keyboard as seen by the direction of his head and gaze as a sign of support.

On reflection, I wondered what Ollie's oddly positioned hand underneath Alex's could have been signifying. Perhaps the action signified: I am bored and being disruptive; I have an idea I want to try and am inspired; or to replicate what Alex had been playing in a moment of materialisation (which is what happened).

5.2.4 Episode Eleven

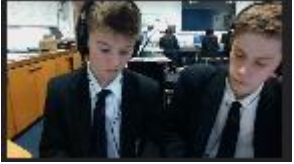
In the sequence of instances of non-verbal communication, Episode Eleven represents the last episode of the lesson. It is also the final episode being analysed from Lesson One. In this episode, Ollie instructs Alex to put his headphones on and watches closely to ensure that he is ready to listen to Ollie play the keyboard. As this episode occurred so close to the end of the lesson, I question Ollie's urgency and motives to share his keyboard playing. Perhaps it was a demonstration of his idea towards the composition.

Mapping of resources available for communication

Preceding Modal Prompt [Lesson 1 Episode 11]								
Ollie gesture, gaze + speech (<i>put your headphones in</i>)								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer- generated Sound
12:57 (19)			Alex putting headphones on	Ollie's hands are over the keys on the keyboard	Ollie looks towards his partner		Ollie sits close to the desk, positioned slightly in front of Alex	Ollie headphones on
12:58			Ollie plays the keyboard	Ollie turns head to his right	Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Alex leans to his left; head positioned to see Ollie play the keyboard	Both have headphones on

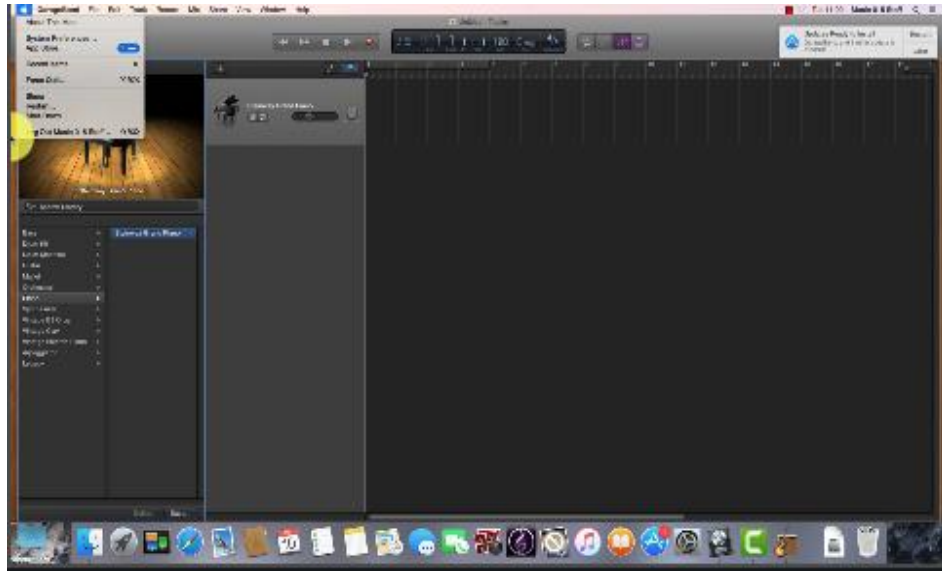
12:59			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:00			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:01			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on

13:02			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:03			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:04			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on

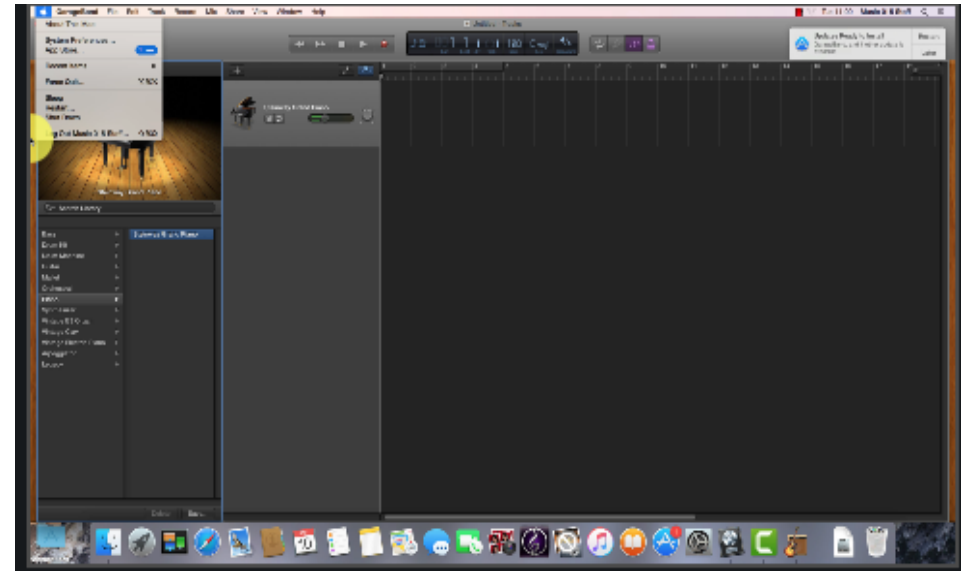
13:05			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:06			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex looks downwards at Ollie's hands		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:07			Ollie plays the keyboard		Ollie focuses on his hands on the keyboard; Alex's eyes gaze upwards		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on

13:08				Ollie turns his head left to look at Alex	Ollie looks directly at Alex Alex glances downwards		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:09			Ollie plays the keyboard		Ollie puts his head down Alex glances downwards		Ollie sits close to the desk, positioned slightly in front of Alex; Alex remains leaning to his left	Both have headphones on
13:10			Alex starts to remove his headphones	Alex turns head away from Ollie (left)		Ollie begins to laugh	Ollie moves his body to the right, away from the keyboard	
13:10 (28)								

Screenshots of Episode Eleven



12:57 Screenshot of the episode's first frame



13:10 (28) Screenshot of the episode's end frame

As with the screenshots from the previous three episodes, there are no crystallisations of compositional ideas, such as character motifs. This means that no recordings or compositional ideas have been formalised on the computer. It is noticeable that Episode Eleven's screenshots are similar to those in Episodes Two and Seven. Without these crystallisations, there is little evidence of pupil progress being visible on the computer screen and the teacher may be wondering what learning Alex and Ollie have achieved.

Interpretation of Episode Eleven

The episode was 14 seconds in which Alex responded to Ollie's verbal preceding modal prompt of, '*Put your headphones in,*' by doing just that. This action, combined with Alex's body posture (leaning to his left) with his head angled towards the direction of Ollie playing the keyboard, signalled he was ready. Ollie watched and waited for his partner to complete these actions and once completed he began to demonstrate his idea. For the ten-second duration (12:58 to 13:07), Ollie's gaze was intently focused on whatever he played and followed the placement of his fingers on the keys. His upright posture controlled the narrative which suggested not only that he had a musical idea but that he was also proud of it. The sound produced was heard as Alex maintained his posture and gaze. These interactions were ratified in this episode as Alex continued to watch Ollie play the keyboard.

At 13:08, Ollie completed his melody and turned his head left towards Alex looking directly at him. His gesture and gaze signalled that he had finished playing and expected some form of response, perhaps approval. The next two frames were unexpected as whatever Ollie had played prompted the reaction of laughter (13:09 and 13:10). For Alex, this laughter suggested Ollie's idea was less serious than he originally thought, as shown by him turning away and removing his headphones at 13:10, signifying that he had heard enough. The response of laughter could also imply Ollie's embarrassment in trying his idea out. As this was the final episode, no further evidence was provided to suggest that Ollie's idea was incorporated into the composition. It was unclear whether Ollie had a genuine idea or whether he was showcasing something he had learned to play. What comes across in the episode was Ollie's determination, control and agency in sharing something with his partner. Whatever Ollie played on the keyboard was likely not a result of the lesson but did show some prior learning.

In playing the keyboard, Ollie communicated two meanings. The first relates to Ollie's interest and prior experiences in which his verbal instruction became ratified during the episode as he demonstrated this to his partner (Goodwin, 2000). Ollie chose to play the keyboard, which foregrounded the modes of sound and action. For his partner to appreciate the meaning projected, Alex drew on the resources of modes of gaze and its

consistent direction. The context of the music classroom with these particular modes and their resources showed that Ollie could play the keyboard, could generate musical ideas, and he was able to share his musical intentions.

The second point to raise occurred towards the end of the episode from 13:08 until the last frame at 13:10, in which the pupils' ensemble of modes transformed the meaning being made. The change of modes suggested an alternate meaning where Ollie's interactions could have been associated with frivolous actions. We know this as Alex's selected modes showed his disengagement from Ollie as he foregrounded body movement, action and gaze while moving away from the keyboard, signifying that he had finished listening.

Biasutti (2012) emphasised that pupils often demonstrate what they already know to generate further ideas, which seemed plausible in this instance. However, I questioned why Ollie chose to communicate this musical idea at the penultimate point before packing up. Of course, it is possible that despite Ollie laughing, he demonstrated an idea that was valid. It was just not evidenced on GarageBand, as shown in the two screenshots for this episode.

5.2.5 Summary of Lesson One

The pupils had only 11 minutes of compositional time at the computer following nearly 40 minutes of teacher input on a new compositional topic. The four instances of non-verbal communication in Lesson One lasted for over one minute. In the preceding moments to each selected episode, there were various modal prompts: teacher's verbal instructions, pupils' action with notation on a worksheet, sound produced by the action of Alex playing the keyboard, and Ollie's verbal instruction and gaze towards his partner. These preceding modal prompts were not always attended to within the instance of non-verbal communication with which they were associated, and this was especially evident in the first two episodes. However, Episode Eleven showed a simple relationship between Ollie's verbal preceding modal prompt and the instance of non-verbal communication. This communication illustrated a moment of transformation

where the pupils' meaning-making materialised but later in this episode was obscured by their laughter.

The preceding modal prompt for Episode One, as indicated by Alex, suggested that they needed a bassline. Even though his communication was not the dominant modal prompt, Ollie's learning was shaped by his subjective interpretation of it. In the same episode, Alex's interest lay predominantly in finding a pen, with the intention that he may then attend to the teacher's verbal prompt. In the first part of Episode Two, the salience of the teacher's verbal prompt was evident as the pupils acted upon it. Alex rethought his decision to use a pen as he considered which object would best aid his meaning-making. As such, he chose to play the scale on the keyboard rather than opting for an alternative semiotic resource for notating, i.e. using the score function to notate on GarageBand. This decision emphasised a transduction of semiotic resources as Alex remade meaning from written text to playing the keyboard. As Alex was not wearing headphones, there was a discrepancy in how this transduction supported his design for learning, even if it did uphold that his meaning-making was continuous.

The dominant modes noted in the mapping of available resources for non-verbal communication often changed during social interaction. This finding is consistent with multimodal social semiotic theory, in which the pupils' processes of transduction and transformation enabled their meaning-making to become visible. As a result, the signs, additional prompts, and communication within the instances of non-verbal communication enabled a shared negotiation of their workspace as they needed it *in situ*. As apparent from the episodes, it was clear that the pupils were constantly engaged in meaning-making, allowing their design for learning to be discerned. Using a remote point of reference to the teacher's pedagogical design, Episode Two sees the pupils attending to notation, whereas during Episodes Seven and Eleven, the pupils start to consider their first motif. Finally, it is worth noting that the screenshots from the first and last frame of each instance of non-verbal communication do not show nor substantiate any learning that has occurred.

5.3 Lesson Two - The Harmonic Framework and Leitmotifs

Similar to Lesson One, the analysis begins with a brief contextual overview of the lesson prior to the pupils starting their compositional work at the computer. There are four distinct subsections where each one represents an episode. Each episode will start by positioning its place within the overall context of the lesson and provide the mapping of resources available for non-verbal communication. Next, two screenshots of GarageBand show the episodes' first and last frames, along with my analysis. Finally, the accompanying interpretation from the data analysis highlights the pupils' transformations and materialisation of learning. The section concludes with a summary of the lesson's findings.

Lesson Context

It was 2.30 pm, and the last lesson of the day. The lesson started as the teacher questioned the class – What is a leitmotif, and how can they change? Twenty minutes passed and the teacher went into depth about how the different elements of music contribute to each leitmotif. Further discussion and instruction included the topics of fragmentation and the use of repetitive ostinato, conducted through a whole-class interactive question-and-answer session. The teacher was explicit with the expectation that the pupils were to complete all three character motifs in their compositional work. The pedagogical framing of the task concerned the importance of understanding the harmonic framework and adapting their compositional ideas within it.

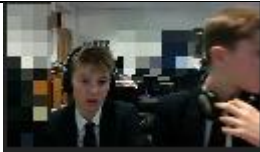
The pupils received instructions to set up the computer with headphones and import the Dr Who clip (BBC, 2012). This 'setting up' took a little longer than anticipated as the clip would not play, and the teacher helped to resolve the problem. Once resolved, Alex and Ollie settled down to work. The compositional time began with a discussion about whether Alex and Ollie wanted to start composing music for the TARDIS or to re-watch the whole Dr Who clip (BBC, 2012).

5.3.1 Episode Six

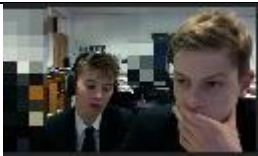
Six minutes of composition time had passed prior to the start of this episode, during which Alex tested out chords, and Ollie re-watched the Dr Who clip (BBC, 2012). Both pupils had decided that they needed to focus on composing something for the character of the Doctor, but instead, they created a melody for Clara. Ollie asked Alex what he was doing and then grinned at him. Alex stopped playing the keyboard, took off his headphones and exclaimed that he did not know.

The preceding modal prompt for the episode was Alex saying, '*We have to get something don't we?*' whilst Ollie was playing low-pitched notes on the keyboard.

Mapping of resources available for communication

Preceding Modal Prompt [Lesson 2 Episode 6] Ollie action playing low pitch notes on keyboard Alex speech (<i>we have to get something don't we?</i>)								
Time	Integrated Webcam	Side Camera	Action	Pointing/gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
06:26 (09)			Ollie plays the keyboard	Alex head down to the left with hand over eyes	Ollie's gaze rests on his hands playing the keyboard		Alex sits slumped at desk leaning on left elbow	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:27			Ollie plays the keyboard	Alex turns his head left away from Ollie	Ollie's gaze rests on his hands playing the keyboard Alex looks at other peers in the classroom		Alex turns his back facing away from his partner	Ollie headphones on Classic Electric Piano – low pitched note(s)

06:28			Ollie plays the keyboard		Ollie gazes at monitor Alex looks at other peers in the classroom		Alex leans further to his left away from his partner	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:29			Ollie plays the keyboard		Alex gazes right at monitor level Ollie refocuses on left hand on keyboard		Alex turns his body and head back towards the desk	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:30			Ollie plays the keyboard	Alex's left hand raises towards his chin	Alex's head turns back to look at monitor Ollie refocuses on left hand on keyboard		Alex reaches in front of, and over Ollie's arm to get to the mouse	Ollie headphones on Classic Electric Piano - low pitched note(s)

06:31			Ollie continues to play the keyboard Alex lifts the mouse	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie focuses his gaze on his left hand on the keyboard Alex glances to the right of the monitor		Alex moves closer to the desk as he rests elbow on desk Ollie's left arm remains under Alex's; Ollie is sat further back in his seat (behind Alex)	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:32			Ollie continues to play the keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie focuses his gaze on his left hand on the keyboard Alex's gaze remains to the right of the monitor		Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on

06:33			Ollie continues to play the keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie focuses his gaze on his left hand on the keyboard Alex's gaze moves to the left on the monitor		Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:34			Ollie continues to play the keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie looks up at the monitor Alex's gaze continues to the left on the monitor		Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on Classic Electric Piano - low pitched note(s)

06:35			Ollie continues to play the keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie looks up at the monitor Alex's gaze continues to the left on the monitor		Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:36			Ollie continues to play the keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie looks up at the monitor Alex's gaze continues to the left on the monitor but slightly lowered		Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on Classic Electric Piano - low pitched note(s)
06:37			Ollie starts to run hand along the keys from low to high pitch	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie looks up at the monitor Alex's gaze continues to the left on the monitor		Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on the keys being swiped

06:38			Ollie runs hand along the keys from low to high pitch	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie refocuses on his left hand on the keyboard Alex's gaze continues to the left on the monitor		Alex moving backwards slightly; Alex rests left elbow on desk supporting his head; right arm remains in front of, and over Ollie's left arm	Ollie headphones on the keys being swiped
06:39			Ollie runs hand along the keys from low to high pitch	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie moves his gaze to the right Alex's gaze continues to the left on the monitor			Ollie headphones on the keys being swiped

06:40			Ollie playing keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie continues to move his gaze to the right Alex's gaze continues to the left on the monitor			Ollie headphones on Classic electric keyboard - melody (mid pitched notes)
06:41			Ollie playing keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie settles his gaze on his left hand playing the keyboard Alex's gaze continues to the left on the monitor			Ollie headphones on Classic electric keyboard - melody (mid pitched notes)
06:42			Ollie playing keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie's gaze remains on his left hand playing the keyboard Alex's gaze continues to the left on the monitor	Alex frowns		Ollie headphones on Classic electric keyboard - melody (mid pitched notes)

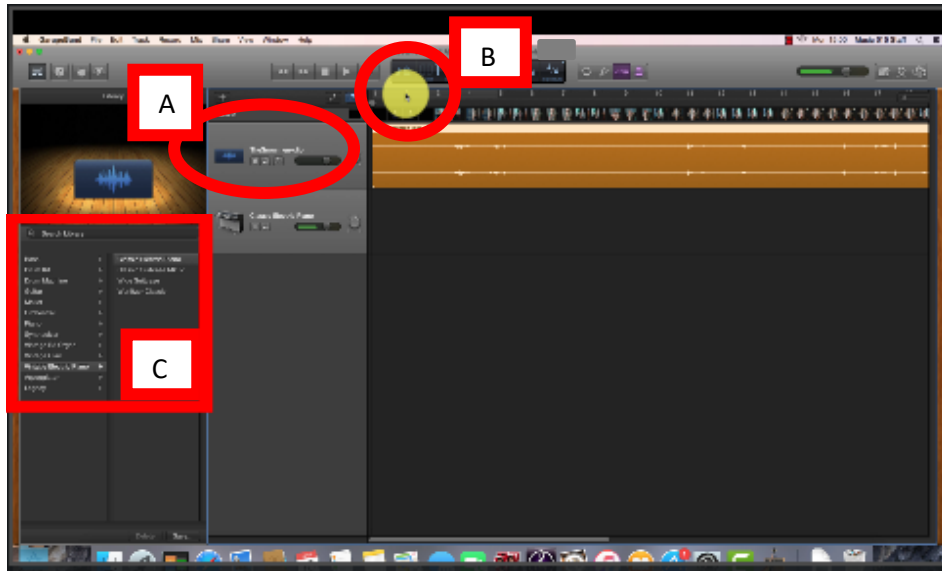
06:43			Ollie playing keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie settles his gaze on his left hand playing the keyboard Alex's gaze continues to the left on the monitor	Alex frowns		Ollie headphones on Classic electric keyboard - melody (mid pitched notes)
06:44			Ollie playing keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie continues to watch his left hand playing the keyboard	Alex frowns		Ollie headphones on Classic electric keyboard - melody (mid pitched notes)
06:45			Ollie playing keyboard	Alex's left hand resting covering mouth, thumb on cheek; moving the mouse	Ollie continues to watch his left hand playing the keyboard			Ollie headphones on Classic electric keyboard - melody (mid pitched notes)

06:46			Ollie playing keyboard Alex mouse - selecting instrument	Alex moves left hand resting covering mouth, thumb on cheek	Ollie continues to watch his left hand playing the keyboard			Ollie headphones on Classic electric keyboard - melody (mid pitched notes)
06:47			Ollie playing keyboard Alex mouse - selecting instrument	Alex moves left hand resting covering mouth, thumb on cheek	Ollie continues to watch his left hand playing the keyboard			Ollie headphones on Classic electric keyboard - melody (mid pitched notes)
06:48			Ollie playing keyboard Alex reaches for headphones around neck		Ollie continues to watch his left hand playing the keyboard			Ollie headphones on Classic electric keyboard - melody (mid pitched notes)

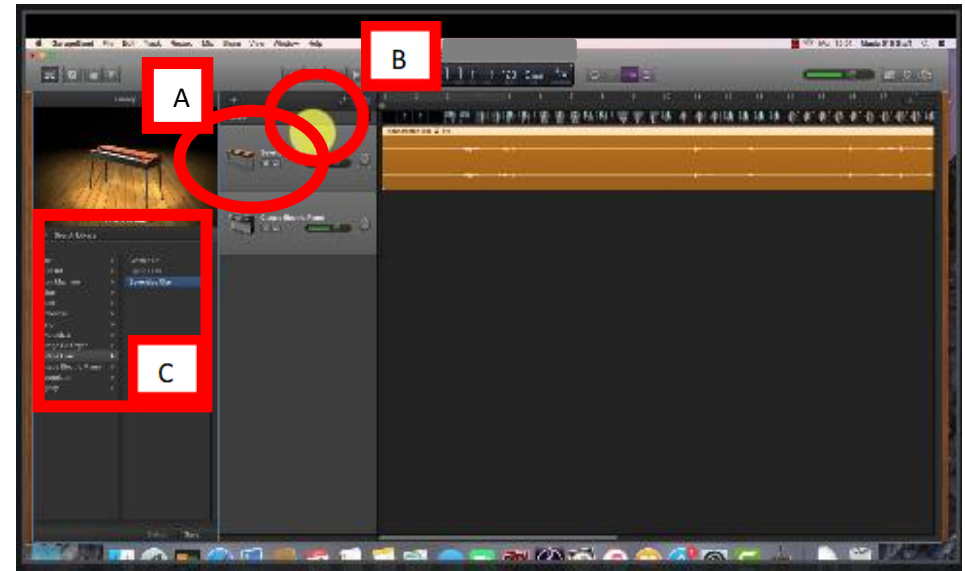
06:49			Both playing the keyboard		Ollie continues to watch his left hand playing the keyboard Alex looks downwards at his hands on the keyboard			Both have headphones on Classic electric keyboard Ollie: melody mid pitch Alex: different melody lower pitched
06:50			Alex playing the keyboard	Ollie raises left arm to face	Alex glances at the monitor Ollie is watching Alex		Ollie sits back in his chair angled to see what Alex was doing	Both have headphones on Classic electric keyboard - melody lower pitched
06:51			Alex playing the keyboard		Both look at the monitor			Both have headphones on Classic electric keyboard - melody lower pitched

06:52			Alex playing the keyboard	Alex's left hand resting over mouth (relaxed)	Both look at the monitor			Both have headphones on Classic electric keyboard - melody lower pitched
06:53			Alex playing the keyboard	Alex's left hand resting over mouth (relaxed)	Both look at the monitor			Both have headphones on Classic electric keyboard - melody lower pitched
end 06:53 (27)					Both look at the monitor			Both have headphones on

Screenshots for Episode Six



06:26 (09) Screenshot of the episode's first frame



06:53 (27) Screenshot of the episode's end frame

There are three differences between the screenshots. These changes, indicated in red, lettered A to C. A shows change in the audio track instrumentation; B shows mouse movement, and C highlights changed words and icons on the instrumental panel. First, (A) has consequences for the pupils' design for learning, as the audio and sound effect track for Dr Who (BBC, 2012) were replaced with a keyboard instrument. Second (B), the changed mouse position (yellow circle with arrowhead) shows signs of searching for something. Finally, the instrument library (C), on the left of the interface, shows a different selection of words, images and colours that trialled different instruments.

Interpretation of Episode Six

The 28-second episode communicated three aspects of the pupils' learning and meaning-making. They occur in sequence throughout the sixth non-verbal instance of communication. Alex and Ollie appeared to be working independently, even though they were sitting next to each other, and the analysis foregrounds Alex's semiotic work more than Ollie's. This episode will examine three different orchestrations of modes that occur at 06:26 to 06:30, 06:31 to 06:45 and 06:49 to 06:52.

The interpretation starts with Alex's verbal prompt, '*We have to get something don't we?*' It illustrated his interest in the direction in which to start the composition. The following four frames, between 06:26 and 06:30, orchestrated the modes of body positioning, gaze and hand gesture where the transcript foregrounds head movements as being pertinent to how interpretation materialises. At 06:26, Alex sat with his left elbow leaning on the desk, his body slumped with his head hanging low and his left hand covering his eyes. The ensemble of modes momentarily signalled the emotions of feeling stuck, uncertainty, disempowerment and/or anxiety.

The following two seconds showed Alex sitting upright as he turned his head away from his partner to look at other peers in the classroom at 06:27 and 06:28. Whilst I cannot see what he was focused on, I interpret that he was attending to what his peers were working on. At 06:29, Alex orchestrated a different set of resources as he re-positioned his body and head in an upright position, gazed intently at computer screen level and started to extend his right arm. The change in semiotic resources suggested he knew exactly how to proceed, or at the very least had an idea.

Thereby, Alex's preceding modal prompt of speech emphasised the salience of his interest and was ratified in these four frames in two ways. First, Alex's head movements were foregrounded with his head down, then in an upright position and looking away from his partner into the music room and finally re-engaging by turning back and looking at the computer screen. Second, changes were noted in Alex's choices of semiotic resources which aptly took him towards the next phase of meaning-making indicating he had made a decision.

The duration of the next phase of the pupils' design for learning was 15 seconds from 06:30 to 06:45. During this time, the orchestration of modes, and their resources, differed between Ollie and Alex. Alex was in close proximity to the desk and computer screen which is seen in the transcript through the modes of body positioning and gaze, whereas Ollie sat further back from the desk. Ollie was engaged in playing something on the keyboard. The transcript showed the positioning of his left hand which was pressing on the keys at the lower-pitched end of the keyboard. This action was accompanied by his gaze that consistently focused downwards on the direction of his left hand. It is also possible he listened to the sound as he had headphones on. Camtasia provided the sound as Ollie repeated the same low-pitched melody using the notes *c, c, c, d*.

$C \rightarrow C \rightarrow C \uparrow$ up a semitone D : ||

It was quite possible that Ollie was trialling a melodic idea for a motif or backing track. These interactions further coincided with Alex's own interest at 06:31 and offered an additional interpretation that Alex had assessed and chosen to dismiss Ollie's contribution as not worthy for the composition. The second screenshot of the episode's last frame shows there was no crystallisation of Ollie's idea, and this is also evident from the transcript as Ollie stops playing the keyboard.

Interestingly, analysing the mode of body positioning in isolation with other potential modes would suggest that only Alex was engaged in the task. Although this interpretation may be accurate, the difference in the pupils' orchestration of modes is salient. Here the modes of action and sound became foregrounded in each of the pupils' activities and detailed next.

Between 06:30 and 06:33, Alex visibly leant forward and reached in front of and across Ollie's arm in order to get access to the mouse. What proceeded at 06:31 showed Alex lift the mouse up and down on the desk. Entering Ollie's personal space was a clear sign intended to communicate one of two possibilities to Ollie:

- please stop playing. I have an idea and need your input; and/or

- the mouse is not working properly.

Ollie's recognition of Alex's sign could be interpreted as 'you are in my way' or as being unable to reach the mouse. We know this as Ollie sat further back in his seat emphasised by his body positioning further away from the desk with his left arm stretched out underneath Alex's arm. Undisturbed, Ollie's ensemble of modes of action and gaze remained. This meant Ollie continued to play the keyboard for another 18 seconds until 06:50 which could suggest he was trialling an idea. In contrast, at 06:31, Alex moved closer to the desk and rested his left elbow on it. The repositioning of the elbow meant Alex's head rested in his left hand. His fingers covered his mouth with his thumb on his cheek (as pictured in Fig 5.3). The hand gesture suggested he was thinking or trying to make sense of his own actions whilst his right hand continued to cover and move the mouse.



Figure 5.3: Screenshot taken from Lesson Two at 06:31 - Alex's hand gesture, 'thinking'

The orchestration of Alex's modes: left handed gesture (as shown in Fig 5.3) with his right hand on the mouse along with directional gaze and close proximity to the computer screen, indicated that Alex was searching for something on the software interface. This configuration shaped his meaning-making which lasted for 16 seconds until Alex selected an instrument. An alternative interpretation could suggest that the gesture may have been caused by an increase in anxiety or that something was holding Alex back as the idea was not yet fully formed.

The third and final phase of this episode occurred from 06:50 to the end of the episode at 06:53. Again, Ollie's ensemble of modes differed from that of Alex's. In particular, Ollie foregrounded the modes of positioning, gaze and sound. Ollie sat back in his seat, positioned behind Alex, and watched the computer screen. It appeared that Ollie was listening as he wore headphones. These modes orchestrated Ollie's design for learning which can be interpreted in two different ways. First, Ollie's continued engagement in the task as he responded to Alex's spatial proximity by moving backwards, watching and listening to his partner's input. The second interpretation could suggest that Ollie was waiting for Alex to produce an idea and was perhaps less engaged in the creation of the composition. Either way, what is communicated in the transformation at 06:52 is Ollie's acceptance of Alex playing the keyboard.

This notion of acceptance is further ratified in the orchestration of Alex's modes. Here Alex's modes of gaze, gesture, movement and sound come together to illustrate his design for learning. Firstly, in not knowing where to start at the beginning of the episode, Alex looked around the room at his peers. This provided a starting point which led to the search and selection of an instrument. Secondly, through foregrounding action, sound and gaze he played the keyboard in order to try out an idea. However, the small transformation of his relaxed hand gesture at 06:52 (Figure 5.4) made visible that Alex had overcome the barrier of what to do which is further ratified as he presented his idea through playing the keyboard. Thus, at this point, Alex's learning seemed to materialise.



Figure 5.4: Screenshot from Lesson Two at 06:52 - Alex's hand gesture, 'knowing what to do'

To summarise, the episode's duration was 28 seconds. In this instance of non-verbal communication, Alex's design for learning was prominent and followed the pattern of decision-making, searching for an instrument and trying out ideas. It is the trying out of his idea that demonstrated materialisation of his learning. In contrast, Ollie's design for learning emphasised trialling an idea which partially materialised into learning at 06:50 when he stopped playing the keyboard and attended to what Alex was doing.

5.3.2 Episode Nine

There was approximately four minutes between Episodes Six and Nine in which both pupils continued to trial compositional ideas. The phase in the lesson of this ninth episode shows a distribution of activities and the negotiation of the pupils' trial-and-error approach in finding a suitable instrument. The duration of the instance of non-verbal communication was 27 seconds.

Mapping of resources available for communication

Preceding Modal Prompt [Lesson 2 Episode 9] Alex speech (<i>inaudible</i>) and gesture at monitor Ollie action keyboard and mouse								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
10:50 (08)			Ollie plays the keyboard Alex selects percussion using mouse	Alex places hand over mouse; Alex's left hand resting covering mouth, thumb on cheek	Both looking to the left of the monitor	Ollie's mouth is slightly open	Alex resting elbow on desk, hunched shoulders Ollie sat back in seat, turned slightly left	woodblock sound

10:51			Ollie plays the keyboard Alex selects percussion using mouse	Alex's left hand resting covering mouth, thumb on cheek	Both looking to the left of the monitor	Ollie's mouth remains open	Alex resting elbow on desk, hunched shoulders Ollie tilts head to the left	Guiro (scraping) percussion sound
10:52				Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Both looking to the left of the monitor		Alex resting elbow on desk moves further to his left	no sound
10:53			Ollie selects flute using the mouse	Alex points to the instrument panel on the monitor; Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor, Alex glances downwards to the right			no sound

10:54			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex turns head left still looking downwards		Ollie moves body and head position forwards	Flute
10:55			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex lowers head and gaze towards the keyboard			Flute

10:56			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Flute
10:57			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Flute

10:58			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Flute
10:59			Alex plays melody on keyboard Ollie selects piccolo flute using mouse	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Piccolo flute

11:00			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Piccolo flute
11:01			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Piccolo flute

11:02			Alex plays melody on keyboard Ollie selects a legato function on mouse	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Piccolo flute
11:03			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			Piccolo flute

11:04			Alex plays melody on keyboard Ollie selects oboe using mouse	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			oboe
11:05			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			oboe

11:06			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			oboe
11:07			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			oboe

11:08			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			oboe
11:09			Alex plays melody on keyboard Ollie selects English horn legato	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			English horn

11:10			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			English horn
11:11			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			English horn

11:12			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			English horn
11:13			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			English horn

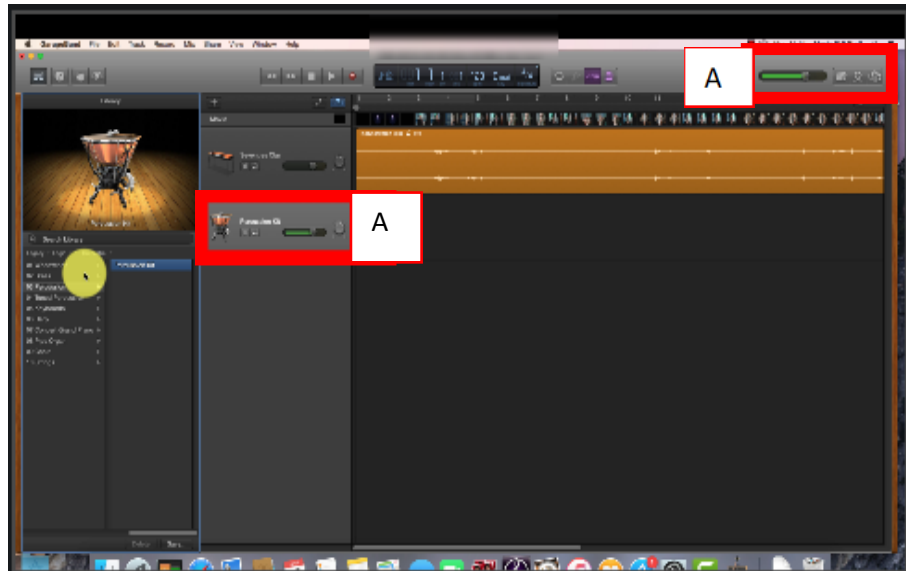
11:14			Alex plays melody on keyboard Ollie selects English horn	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			English horn
11:15			Alex plays melody on keyboard Ollie selects bassoon legato	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			bassoon

11:16			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard	Ollie closes his mouth		bassoon
11:17			Alex plays melody on keyboard	Ollie moves mouse Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at the monitor Alex maintains head down, looking at the keyboard			bassoon

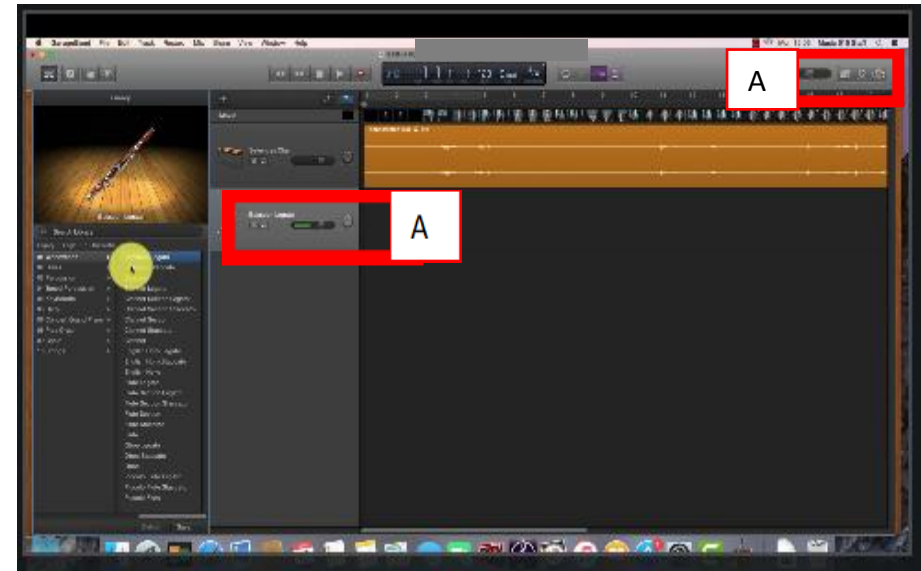
11:17
(15)



Screenshots of Episode Nine



10:50 (08) Screenshot of the episode's first frame



11:17 (15) Screenshot of the episode's end frame

These two screenshots confirm that the mode of sound was present and that someone had played the keyboard. We know this as the track (A) showed a green bar indicating the presence of sound. A difference between these frames showed that the instrument selection had changed. The first screenshot depicts a timpani instrument whereas the end screenshot shows a bassoon. The change in images signified that either Alex and/or Ollie experimented with different instrumental sounds. This interaction, and its associated track, was assumed by me to be for the composition of the first motif, simply as the track's adjacent emptiness signified nothing had been crystallised.

Interpretation of Episode Nine

The episode duration was 27 seconds. In this time, it was noted that there was a shared objective of a trial-and-error approach to finding an instrument and the creation of a motif. The pupils attended to different elements within the episode and orchestrated their own ensemble of modes and their resources.

Ollie initially orchestrated the modes of action, gaze, facial expression and sound between 10:50 and 10:53 to attend to the testing out of instrumental sounds. In the next frame (10:54) and up until 11:16 the resources of these modes transformed where Ollie's participation progressed to searching for the appropriate instrument. In contrast, Alex orchestrated the modes of action, gesture, gaze and body positioning to initially select an instrument using the mouse. Comparably to Ollie, at 10:54, the resources of these modes changed and transpired into a different activity.

The interpretation that follows in this section examines the first three seconds (10:50 to 10:53), the transformation at 10:54 and what the pupils attended to for the remainder of the episode between 10:54 and 11:17.

The instance of non-verbal communication opened after the preceding modal prompts were synchronised. Alex pointed at the computer screen whilst saying something inaudible, whereas Ollie's right hand moved and clicked the mouse as his left played the keyboard. This suggested that Alex's visible signal of pointing was the catalyst for what the pupils attended to. However, the first three frames of the transcript demonstrate that the pupils adopted a different orchestration of modes. Ollie played the keyboard and gazed intently at the computer screen with a facial expression that showed his mouth was slightly open. At this stage, the modes of action, gaze and facial expression communicated Ollie's engagement as he attended to Alex's preceding modal prompt. In comparison, Alex foregrounded the modes of body positioning and gesture although his interaction showed he used the mouse to select two percussion instruments (10:50 and 10:51). The positioning of Alex's left-hand gesture, as shown in Figure 5.5, is similar to that seen in Figure 5.3 (Lesson Two Episode Six, p.179). It was a clear sign that meaning-making occurred and represented Alex taking a moment to think. However,

the orchestration of modes also included Alex's gaze and action. With his eyes focused to the left of the computer screen and his right hand moving the mouse, this would suggest that Alex was searching for something.



Figure 5.5: Screenshot taken from Lesson Two at 10:50 - Alex operating mouse with hand gesture, 'searching'

A slight change in resources occurred at 10:54 that represented how the pupils negotiated an active change in who played the keyboard and who chose the instrument. The swap was prompted by Alex who pointed to the instrument panel on the computer screen. This sign possibly signified that he was happy for Ollie to continue with the searching and decision-making process in selecting an instrument. It was at this point that Ollie's resources of modes changed to aptly attend to the aforementioned activity of locating an appropriate instrument. This means that the ensemble of modes (action, gaze, facial expression and sound) remained the same but the activity utilising each mode had changed. Ollie foregrounded the modes of action and sound whilst he maintained the same facial expression and gaze. Thereby, instead of playing the keyboard Ollie now had control of the mouse to select different instruments. We know that the sound was foregrounded as synchronous playing from Alex enabled Ollie to realise his decisions.

Within the same moment and frame (10:54), Alex also changed his activity from moving the mouse to playing the keyboard. Within this change the mode of sound was added to the ensemble of modes of body positioning, gesture, gaze and action. This addition (the mode of sound) acted as the moment of transduction. It provided Alex the

opportunity to remake his meanings and attend to the composition of the first motif, for example moving from contemplation to action. The changes to the resources of modes further contributed to providing different meaning potentials to Alex's engagement. We know this as Alex's gaze moved downwards from the computer screen, with his head in a lower position and the directionality of his gaze similarly matching, as he watched the placement of his hands on the keyboard. The main difference between 10:50 and 10:53 and now (at 10:54) was that Alex foregrounded the modes of action and sound where it became apparent that he was composing something.

The final occurrence to analyse is from 10:54 until the end of the instance of non-verbal communication at 11:17. Ollie searched for an instrument while Alex composed, although nothing significant was captured until the final two seconds of the episode.

Ollie's orchestration of modes of facial expression, slightly opened mouth, fixed gaze on the computer screen and action of the mouse indicated his engagement and focus. At 11:16 there was a notable change in Ollie's facial expression as he closed his mouth, as shown in Figure 5.6. This signified that Ollie had made his final instrumental selection and, along with the sound, an aspect of learning had been realised. It is of course possible that Ollie had had enough of trying to find appropriate instruments and wanted to move on to the next part of the composition. There was no indication in this instance of non-verbal communication that learning had materialised for Ollie as he stopped moving the mouse and sat back to watch Alex.



Figure 5.6: Screenshot taken from Lesson Two at 11:16 - illustrating the pupils' individual designs for learning

Examining Alex's interactions at 11:16 and 11:17 equally leaves the interpretation open as his design for learning (i.e. composing) continued undisturbed by Ollie's previous signal. Although Alex is partially out of the frame, it is his left-hand gesture that is of interest (Figure 5.6). This particular hand gesture was visible throughout the instance of non-verbal communication (10:52, and 10:55 to 11:17) and signified the ongoing process of contemplation with action. It was Alex's approach to meaning-making that informed his design for learning.

The preceding modal prompt of Alex's inaudible speech and pointing at the computer screen, together with Ollie's actions, became ratified by the pupils' orchestration of modes across three frames from 10:50 to 10:53. There was one notable transformation at 10:54 in which Alex and Ollie seemingly swapped activities. At this point, the ensemble of modes extended to include sound generated by Alex playing the keyboard, which Ollie changed in selecting different instruments. Although materialisation of learning was only partial in this instance, their design for learning encompassed a trial-and-error method to select instruments, to make decisions and to compose.

5.3.3 Episode Fifteen

Following on from Episode Six, the pupils continued to try out their compositional ideas and spent almost three minutes engaged in additional teacher input. During this time, the whole class received a visual demonstration and instruction in how to utilise the quantise function on GarageBand for their motifs and were requested to quantise to quarter notes. The teacher expressed the importance of using quantise and asked pupils to act upon this during the remainder of the lesson. Quantisation in digital music can be described as re-shaping the recorded rhythm to one that more closely represents the composition's digital tempo.

The fifteenth instance of non-verbal communication lasted for a duration of 23 seconds and transpired almost 17 minutes into the lesson. A recording of their first motif changed the pupils' design in learning from trying out ideas and selecting instruments.

Mapping of resources available for communication

The preceding modal prompt ratifies the pupils' compositional intentions shown in the episodes two screenshots. It further indicates Alex's interest in the music lesson which remotely emphasises the teacher's pedagogical framing.

Preceding Modal Prompt [Lesson 2 Episode 15]

Alex Verbal instruction (*hang on*); gesture and pointing of mouse to record

Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
16:51 (29)			Ollie playing the keyboard	Alex left arm extends to reach the mouse	Ollie looking at his fingers on the keyboard Alex gazes at qwerty		Alex leans forward, moving his head to the right; moves his left arm over Ollie's to reach the mouse Ollie sits back in his chair, behind Alex, tilting head slightly to the right	Ollie headphones on Harp

16:52				Alex's left hand resting covering mouth, thumb on cheek; Alex moves the mouse	Both looking at the monitor	Ollie's mouth is open (goes to speak but does not)	Alex straightens body and moves closer to monitor Ollie sits back in chair and removes hands from the desk	Ollie headphones on, no sound
16:53				Alex's left hand resting covering mouth, thumb on cheek; Alex moves the mouse	Both looking at the monitor	Ollie pouts his lips	Ollie tilts head left	Ollie headphones on, no sound
16:54				Alex's left hand resting covering mouth, thumb on cheek; head tilts downwards; Alex moves the mouse	Alex glances downwards	Ollie pouts his lips	Alex moves head downwards	Ollie headphones on, no sound

16:55				Alex's left hand resting covering mouth, thumb on cheek; Alex moves the mouse	Alex glances downwards	Ollie pouts his lips and puffs out his cheeks	Alex moves head position to the right	Ollie headphones on, no sound
16:56			Alex lifts the mouse off the desk	Alex's left hand reaches for headphones	Both looking at the monitor	Ollie pouts his lips and puffs out his cheeks	Alex raises head	Ollie headphones on, no sound
16:57			Alex positions the mouse above the record function		Both looking at the monitor	Ollie pouts his lips and puffs out his cheeks	Alex sits back and tilts head to right	
16:58			Alex clicks the record button using the mouse; Alex pulls up headphones		Alex glances downwards	Ollie pouts his lips and puffs cheeks	Alex leans forward head moving downwards	[click]

16:59			Alex positions headphones		Both looking at the monitor	Ollie smiles	Alex leans to the left; Alex's left hand remains on the headphone earpiece as left elbow rests on the desk	[click, click]
17:00			Alex plays the keyboard		Alex glances downwards at right hand on keyboard Ollie glances downwards at Alex's hand playing the keyboard			[click] melody on harp - one note

17:01			Alex plays the keyboard		Alex continues looking downwards at right hand on keyboard Ollie continues looking at Alex's hand playing the keyboard		Alex leans further to the left	melody on harp - two notes falling by step
17:02			Alex plays the keyboard		Alex continues looking downwards at right hand on keyboard Ollie continues looking at Alex's hand playing the keyboard			melody on harp - one note falling by step; one note up a third

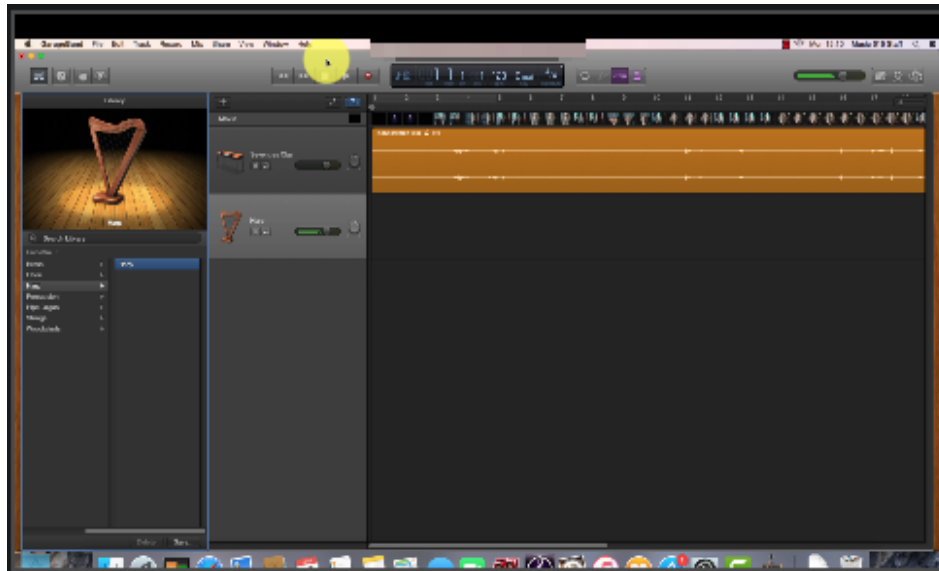
17:03			Alex plays the keyboard		Alex continues looking downwards at right hand on keyboard Ollie continues to look at the monitor			melody on harp - two notes falling by step
17:04			Alex plays the keyboard		Alex continues looking downwards at right hand on keyboard Ollie continues to look at the monitor			melody on harp - two notes falling by step

17:05			Alex plays the keyboard		Alex continues looking downwards at right hand on keyboard Ollie continues to look at the monitor			melody on harp - one note; falls a third; up a tone;
17:06			Alex plays the keyboard		Both looking at the monitor			melody on harp - down a third; up a tone
17:07			Alex plays the keyboard		Both looking at the monitor			melody on harp - one note held

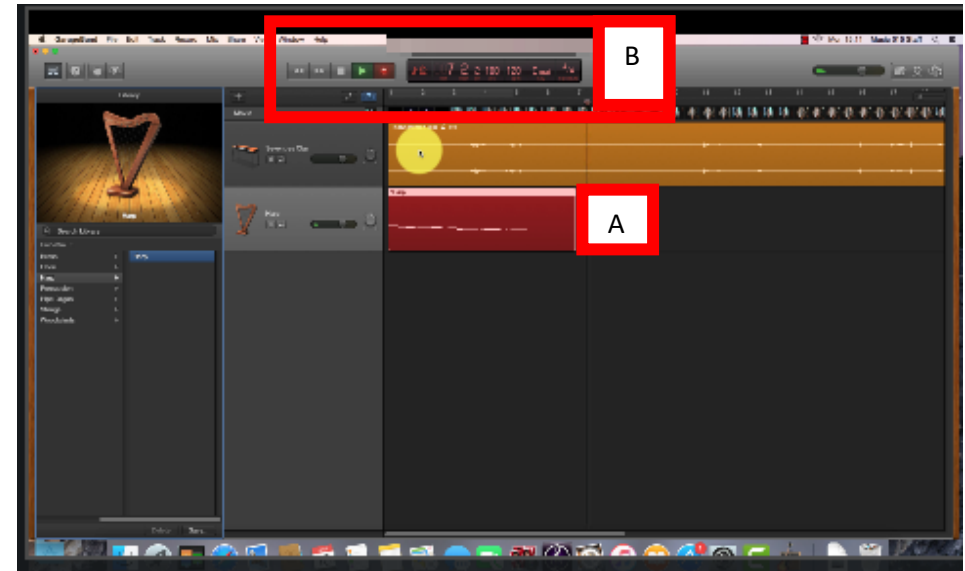
17:08			Alex plays the keyboard		Alex glances downwards at right hand on keyboard Ollie continues to look at the monitor			melody on harp - down a third up a tone
17:09			Alex plays the keyboard		Both looking at the monitor			melody on harp - one note held
17:10			Alex finishes playing the keyboard		Both looking at the monitor; Alex turns head to the right		Alex head raises to straighten	melody on harp - one note
17:11			Alex extends right arm to mouse	Alex's left hand resting covering mouth, thumb on cheek	Alex looks at his hand on the mouse Ollie continues to look at the monitor		Alex turns head right and slightly downwards	

17:12				Alex's right hand on mouse	Alex looks downwards; Ollie continues to look at the monitor		Alex tilts head downwards and removes left hand from face	
17:13 (04)								

Screenshots of Episode Fifteen



16:51 (29) Screenshot of the episode's first frame



17:13 (04) Screenshot of the episode's end frame

The most significant difference between these two screenshots is the recording of the harp motif. This motif is depicted in the end frame where the track shows a red colour (A). Label B illustrates the motif was in the process of being recorded and was the first indication of the pupils' compositional work being crystallised. This means that there is evidence of the pupils' compositional work showing that their ideas, decisions and trying out have come together to create a motif lasting for almost 5 bars. The teacher's pedagogical framing and instructions were to compose motifs lasting for a duration of 4 bars which suggests that this motif was too long.

Interpretation of Episode Fifteen

This fifteenth episode lasted for 22 seconds. The discussion focuses on two distinct aspects of multimodal theory. First, Alex's preceding verbal prompt became ratified through his interactions and communications as well as those of Ollie. Second, an interpretation that combined three synchronous transformations enacted by Alex. The analysis shows that Alex's interactions throughout the episode affected Ollie's design for learning and these moments will be highlighted. Three transformations occurred between 16:52 and 17:10:

- 16:52 to 16:55;
- 16:56 to 16:59; and
- 17:00 to 17:10.

I start with the preceding modal prompt, which noted Alex's verbal instruction of '*hang on,*' amalgamated with his left arm gesturing towards the top of the computer screen. The prompt was directed explicitly at Ollie. We know this as the first frame (16:51) orchestrated the modes of gesture, gaze, and Alex's body movement to attempt to stop Ollie from doing something. Alex's ensemble of modes shows he leaned forward and moved his head to the right as he concurrently moved his right arm over Ollie's. This meant that Alex encroached upon Ollie's personal space, suggesting he wanted Ollie to stop. I assumed this interpretation as being accurate as Ollie's modes and resources of those modes changed within the first two frames. The first frame (16:51) shows Ollie's ensemble of modes as action, gaze and sound. Here, he momentarily played the keyboard whilst watching what he was doing. However, the second frame (16:52) ratified Alex's verbal prompt. Ollie orchestrated another set of resources: action, gaze and facial expression. The transcript shows Ollie removing his hands from the keyboard and desk, seen at 16:52, opening his mouth as if to say something and focusing his gaze on the computer screen. Regardless of whether Ollie was happy or content with being stopped, the communication clearly showed he was being compliant. Although this interaction lasted for two seconds, it ratified Alex's verbal preceding modal prompt.

An alternative interpretation would suggest that Alex was about to use the mouse and was perhaps unconcerned about the intrusion into Ollie's personal space. On reflection,

the interaction suggested Alex's frustration and/or eagerness to get on with the task. It is worth recognising that Ollie's facial expression of pouted lips equally communicated his frustration and/or annoyance with the situation.

Next, this episode's second point of interpretation considers Alex's three synchronous transformations between 16:52 and 17:10. Between 16:52 and 16:55, the transcript depicted a familiar configuration of Alex's left-hand gesture, gaze and action (see Figure 5.7) signifying Alex's contemplation. However, and more salient, Alex's body movement and positioning suggested imminent action.



Figure 5.7: Screenshot taken from Lesson Two at 16:52 - Alex's hand gesture, 'contemplation'

The orchestration of Alex's body movement illustrated his design for learning as being focused and engaged in moving from his contemplation (16:52 to 16:55) to setting something up (16:56 to 16:59), to interaction (17:00 to 17:10). Within these 18-seconds, Alex transformed his intentions as well as the ensemble of modes and their resources three times (detailed in the following paragraphs). Although the transformations occurred in quick succession, the outcome showed that Alex had recorded a leitmotif. I further interpreted Alex's ensemble of modes through the synchronous transformations and encroaching on Ollie's space as a sign of control or dominance over the compositional process.

The first transformation showed Alex straightening his body posture and moving closer to the computer screen (16:52 and 16:53). At 16:54, Alex moved his head and gaze in a downward position towards the desk, which was followed by his tilted head position to

the right at 16:55. Throughout these four seconds Alex continued to move the mouse bringing body movement and action to the fore.

The second transformation from 16:56 to 16:59 highlighted the modes of body movement, gesture, gaze and action. However, Alex's head movement and left-hand gesture signified change. Here, Alex raised his head from a lowered position (16:56), tilted his head to the right (16:57) and leant forward as he pulled up his headphones from his shoulders and put them on over the next two seconds (16:58 and 16:59). The orchestration of these modes signified something was about to be actioned. We can assume the mode of sound would become prominent in the final transformation as the data showed Alex had headphones on. In addition, a click sound indicated the commencement of some form of recording. Generated by the software, the metronome click gave Alex and Ollie an additional cue for what was to follow.

Before discussing the last transformation in this instance of non-verbal communication, I consider Ollie's design for learning so far in this episode as it was unclear what his involvement was, especially as the analysis shows that Alex was in control of composing.

Ollie's gaze, posture, and facial expressions illustrated both his boredom and, conversely, his engagement with Alex's intentions. Focusing on Ollie's facial expressions, he pouted his lips (16:53 to 16:54), continued to pout his lips and puffed out his cheeks (16:55 - 16:58) and, in the subsequent frame, smiled (16:59). We already know that Ollie was being compliant with Alex's preceding verbal prompt, but I continued to interpret the interaction as frustration and/or boredom. In recognising Ollie's modes of gaze and sound, we gain a deeper understanding.

Another interpretation may suggest that Ollie was not actively contributing as he was not physically engaged in the activity nor using the equipment. However, Ollie was engaged. To assist with his learning, he foregrounded the modes of gaze and sound. We know this as Ollie consistently focused on the computer screen or glanced downwards to watch his partner play the keyboard. His body movement remained static as he sat still in his seat with headphones on. However, this episode did not illuminate how Ollie's

learning fully materialised after the episode, and therefore, we only see a partial representation of his engagement.

The final transformation showed Alex orchestrated the modes of action, gaze and sound that contributed to his materialisation of learning. Ollie altered his facial expression in response to what occurred from 17:00 to 17:10. As such, Alex recorded their first leitmotif by inputting the notes through playing the keyboard. He alternated his gaze between the computer screen and hand positioning on the keyboard and continued to wear headphones. Interestingly, Ollie smiled at the start of the recording. This smile was in response to Alex's prompt and signified recognition of the recording.

This fifteenth episode illustrated the complexities and intricate nature of Ollie and Alex's communication as the transformation happened over a matter of seconds. First, Ollie was stopped by Alex from doing whatever he was doing, which further dissuaded Ollie from participating beyond watching and listening. This reaction to Alex's actions raised questions regarding who was in control and what the consequences of this control might be. A longer transformation of approximately six seconds evidenced Alex's contemplation, setting something up and a recording.

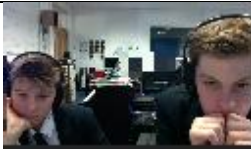
5.3.4 Episode Thirty-three

Since Episode Fifteen, 16 minutes of lesson time elapsed in which just over four minutes were teacher directed as whole class input. The teacher restated three expectations of the lesson. These had a remote point of reference to the teacher's pedagogical framing: compose and complete the three-character motifs, ensure the motifs are quantised and add a harmonic framework.

This thirty-third instance of non-verbal communication occurred approximately ten minutes before the end of the second lesson and is the final episode this section will analyse. It would have been reasonable to assume the teacher's input influenced the pupils' design for learning. However, Alex and Ollie chose to continue with the alignment of the recorded motif, so it corresponded with the visual and audio representations in *Dr Who* (BBC, 2012).

Mapping of resources available for communication

Preceding Modal Prompt [Lesson 2 Episode 33]								
mouse movement; Alex speech (if we mute . . just checking) muting tracks; action headphones								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
31:33 (02)			Alex securing headphones	Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor Alex's eyes focus to the left		Alex leaning forward towards desk hunched shoulders Ollie's right elbow leaning on desk head resting in hand	Ollie headphones on Horn motif
31:34				Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor Alex's eyes focus forward		Alex both elbows resting on desk Ollie's right elbow leaning on desk head resting in hand	Both have headphones on Horn motif

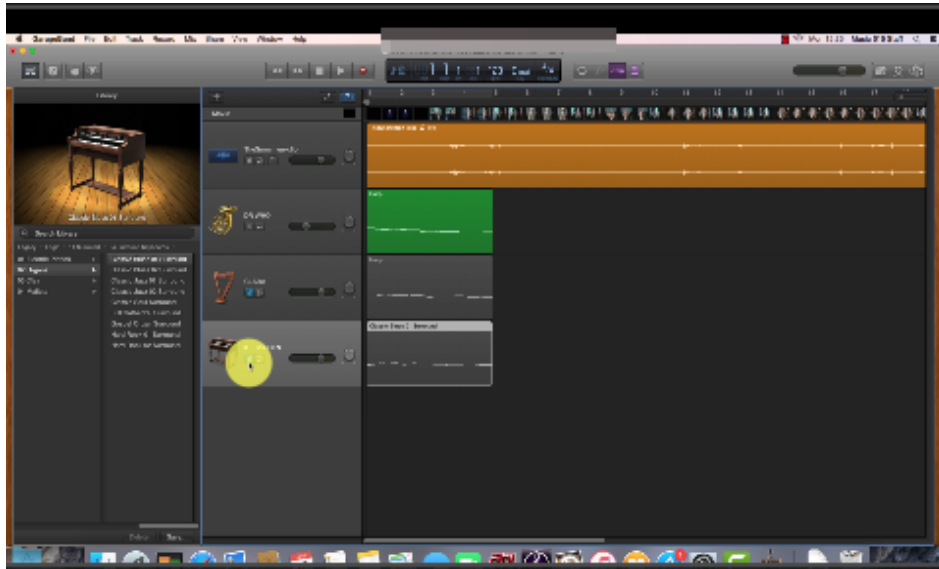
31:35			Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on Horn motif
31:36			Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on Horn motif
31:37			Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on Horn motif

31:38	Photo removed in this version		Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on Horn motif Dr (<i>I</i>)
31:39	Photo removed in this version		Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on Horn motif Dr (<i>never know why,</i>)
31:40	Photo removed in this version		Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on Horn motif Dr (<i>why,</i>)

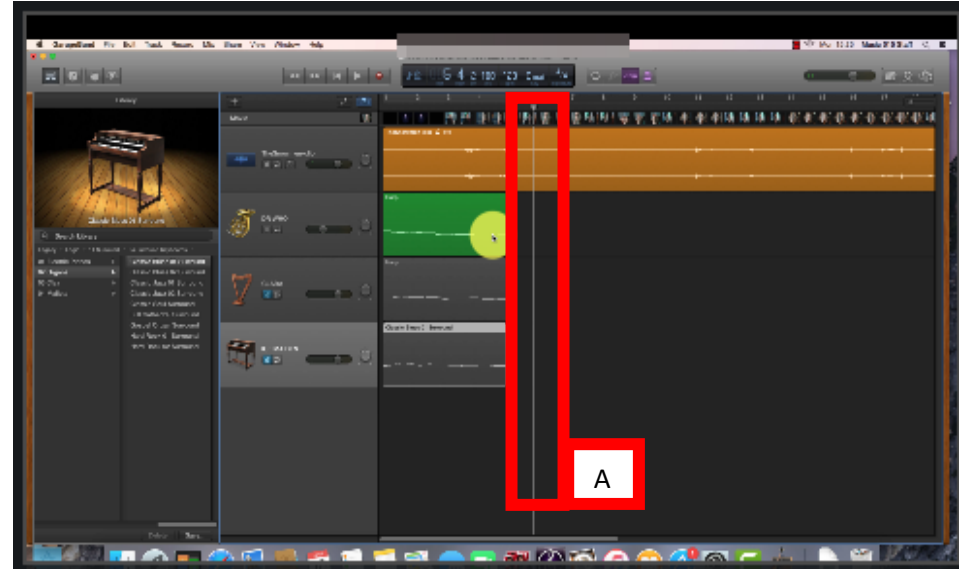
31:41	Photo removed in this version			Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on <i>Dr (I only know)</i>
31:42	Photo removed in this version			Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor Alex's eyes focus right			Both have headphones on <i>Dr (who)</i>
31:43	Photo removed in this version		Ollie qwerty - stop function	Alex's head resting on fist shaped hands; covering mouth Ollie's right hand resting on cheek as he leans on desk	Both looking at the monitor			Both have headphones on

31:44			Alex starts to remove headphones	Ollie moves mouse right hand; left hand rests in front of qwerty	Both looking at the monitor		Alex sits upright Ollie sits upright	Both have headphones on
31:45				Ollie moves mouse right hand; left hand rests in front of qwerty	Both looking at the monitor with more intensity		Ollie moves body further to the left closer to Alex	Ollie has headphones on
31:45 (18)								

Screenshots of Episode Thirty-three



31:33 (02) Screenshot of the episode's first frame



31:45 (18) Screenshot of the episode's end frame

There are two differences between these screenshots. The first shows mouse movement, indicated by the yellow circle and arrowhead, whereas the second shows the position of the vertical timeline indicator in the composition (A). Further information obtained from the screenshots shows an increase of recorded motifs, from one to three (positioned under the orange horizontal block), where images of the French horn, harp and keyboard are situated. The first screenshot shows two motifs or tracks are muted, leaving the horn motif (the track in green) as the possible focus for the episode. Two tracks are muted, indicated by their greyed-out appearance and a blue speaker icon with a line through it next to each track.

Interpretation of Episode Thirty-three

The analysis and interpretations in Episode Thirty-three are taken from two separate points in the pupils' instance of non-verbal communication. The first combines the preceding modal prompt and its subsequent ten seconds (31:33 to 31:43). This data is from the transcript and the first screenshot. The second part discusses the materialisation of Alex and Ollie's learning that occurred at 31:44 and involves a transformation of resources.

Ollie orchestrated the modes of body positioning, gaze and gesture that signalled his boredom and/or tiredness but also his continued engagement in what was going on, albeit with less motivation than Alex. Ollie had headphones on, which suggested he may be listening to the horn motif playing. We know Ollie was engaged as the ensemble of modes and their resources remained the same for ten seconds between 31:33 and 31:43. The transcript shows Ollie leant on the desk with his right elbow, rested his head in the palm of his hand and fixed his gaze on the computer screen. I interpreted the ensemble of modes and lack of action as boredom.

In contrast, Alex orchestrated the same modes of body positioning, gaze and gesture but with different resources within those modes, which communicated his focus and intent. The transcript showed that Alex placed both elbows on the desk and rested his head on a fist-shaped hand, covering his mouth. This gesture, forward-leaning posture towards the computer screen and focused gaze at the screen suggested intensity and his explicit communication in listening to and watching the track. Similarly to Ollie, this was a sustained moment of focus, which lasted for ten seconds between 31:33 and 31:43.

At 31:44, we can hypothetically recover two simultaneous interpretations. The first suggests a materialisation in the pupils' learning. The second highlights a moment of realisation between Alex and Ollie in the composition, which then transformed and foregrounded the mode of body positioning. As such, the pupils moved from their previous positions of leaning on the desk to sitting upright. The interpretation of this movement would suggest that the pupils had identified and located a position for the

motif that they judged to work against the horn track. We know this as seen through the orchestration of modes after both pupils sat upright. This analysis focuses on the moment identified in the transcript as the final two seconds of this instance of non-verbal communication (31:44 and 31:45).

Ollie initiated the transformation when he pressed the spacebar on the QWERTY keyboard after he heard the Doctor say, '*Who.*' Having stopped the playback, Ollie sat up straight and gazed directly at the computer screen. With his right hand, he manipulated the mouse, and the vertical timeline indicator moved the recording to the correct instant. Alex closely watched as he sat upright but removed his headphones. For Alex, removing his headphones signified a change in activity and one that perhaps required speech. Both pupils gazed more intensely at the computer screen, and Ollie repositioned himself, closing the gap between himself and his partner. In these two seconds, the ensemble of modes included gesture, gaze, body positioning and sound. However, Ollie and Alex showed differences in the resources of modes for gesture and sound. Ollie used his right hand to move the mouse into the position, whereas Alex placed his left hand on his chest. This synchronous interaction likely meant that Alex did not hear the sound generated by Ollie as he moved the mouse over the score, making adjustments and pinpointing the exact moment for the movie marker.

5.3.5 Summary of Lesson Two

The second lesson was approximately 42 minutes, and there was a total of 42 instances of non-verbal communication. Seven additional interactions incorporated the teacher and included whole class input. These teacher-led inputs accounted for a total of 7 minutes and 27 seconds and resolved issues with technology, reiterated pedagogical framing and supported Ollie's musical understanding when he requested help. This meant that the pupils had less time to compose at the computer. These specific communications may deflect from the overall homogeneity of the pupils' instances of non-verbal communication and/or disrupt the flow of the lesson. However, contextually, the inputs existed and may have shaped the pupils' meaning-making. The time allocated for the pupils' compositional activities was 35 minutes.

Within the lesson, four episodes revealed three distinct compositional activities: selecting an instrument, recording the motif, and reviewing and aligning the motif to the character. The four instances of non-verbal communication in Lesson Two lasted just under two minutes. The preceding modal prompts involved more complex configurations of modes and their resources, which both pupils simultaneously embodied for continuous meaning-making. These included:

- Alex's verbalised question with Ollie's action of playing the keyboard;
- Alex's hand gesture towards the computer screen whilst Ollie operated the mouse in his right hand with the keyboard in his left-hand;
- Alex points the mouse at the record icon as a gesture; and
- Alex's action with both hands occupied, where the right-hand moved the mouse and his left-hand adjusted his headphones.

In contrast to Lesson One, these preceding modal prompts were partially ongoing within the instance of non-verbal communication they were associated to. However, the dominant modes recorded in the mapping of resources available for non-verbal communication sometimes changed as a result of transduction (Episodes Nine and Thirty-three), transformation of resources (Episode Six) and/or materialisation of meaning (Episode Fifteen).

In Episode Six, the analysis focused more on Alex than Ollie. This interpretation was not from the two screenshots of the first and end frames but because the multimodal social semiotic analysis revealed how Alex tried to resolve a compositional dilemma. What became of interest was the meaning-making attached to the orchestration of modes, and particularly Alex's hand gestures. Within this lesson, and across all four episodes, his hand gestures communicated specific meanings, which mostly shared the same three modes of gesture, gaze and action. These included searching for something at 06:31; resolution and/or completion at 06:52; contemplation at 10:52, between 10:55 and 11:17, and lastly at 16:51; and intensity in focus between 31:34 and 31:43. One anomaly was identified at 06:26 (Episode Six) where the analysis suggested Alex was

stuck, uncertain, disempowered and/or anxious through the modes of gesture and gaze, with his head tilted downwards close to the desk and his left hand covering his eyes. Episodes Six and Nine both illustrated the process of selecting an instrument. However, there was a strong disassociation between Alex and Ollie's interactions in the selection process. In Episode Six, the pupils generated multiple signs, some of which were acted upon while others ignored. For example, Alex ignored what Ollie played on the keyboard. The salience of this point demonstrated meaning-making was individualised rather than co-constructed. Although meaning-making was an independent activity, negotiation surrounding access and placement of objects existed, for instance the mouse and their seating positions. In contrast, Episode Nine evidenced both pupils as being actively engaged in the negotiation, selection and distribution of choice.

The initial pedagogical framing (Appendix A) specified that pupils would complete the composition of their leitmotifs. The data reported in the two screenshots from Episode Thirty-three provided preliminary evidence of three motifs haven been composed. Between Episodes Fifteen and Thirty-three, within 16 minutes, two of the three motifs were composed.

The next section (5.4) examines the data, presents the analysis and offers my interpretations from Lesson Three. The expectation was for pupils to match their compositional sounds to the action in the Dr Who clip (BBC, 2012).

5.4 Lesson Three – Matching the Action

This section details the findings of the third lesson, where I continue to adopt a qualitative and interpretative approach to multimodal social semiotic analysis. Section 5.4 is organised and formatted in the same manner as the previous two lessons and includes the following:

- a contextual overview of the lesson including the teacher's pedagogical framing;
- four distinct sections where each section represents an episode;
- each episode shall indicate the overall context and its positioning within the framing of the whole lesson; and
- a summary of lesson three.

This lesson presents interpretations from four episodes which share compositional approaches of 'composing' and 'editing and/or refining'. That is, a more sophisticated dimension of editing that required the pupils' knowledge of the computer program as well as technicalities of how to manipulate and mix the sound, such as panning, quantisation and adding movie markers. The most striking difference between the previous two lessons and Lesson Three was the inconsistency in the length of composition time given to the pupils in which Alex and Ollie had just over 20 minutes of computer-based compositional time.

Lesson Context

The lesson started with a quick fire pupil-teacher round, in which key questions and words used to describe elements of music were exchanged such as: What is a motif? What is a Soundtrack? What is a Movie Marker? What are Dynamics? The teacher's input set the task's expectations for pupils to compose background music, a soundtrack to the Dr Who clip (BBC, 2012). Pupils were encouraged to incorporate a musical and arguably technical device, namely movie markers defined as transition moments between the music and a specific part of a scene, such as Clara saying 'who?' just before the Ice Governess grabs her.

The teacher's pedagogical framing of the task indicated that all pupils were required to understand how film music works with the visual action in order for the compositional product to be successful (Appendix A). The teacher's continued verbal reinforcement about movie markers assumed the pupils would be able to identify important action points in the film clip and continue to compose their own leitmotifs to compliment the action.

5.4.1 Episode Five

Within the first four minutes of composition time, Ollie alternated between Clara's motif and the Ice Governess (the villain), in which he listened and then muted each of the tracks. Alex synchronously replaced his headphones. Ollie asked Alex, 'How do you slow down the tempo?' and received a shoulder shrug as he uttered, 'errm?' No resolution was forthcoming or observed in the Camtasia footage.

Episode Five continued after the above occurrence, where Alex moved back from the keyboard and asked, '*How we gonna do this?*' as he turned his head away from Ollie. I interpreted '*this*' from a pedagogic perspective where the teacher had set clear expectations to identify important moments from the media track and create movie markers. Adding movie markers was something both Alex and Ollie had accomplished in Lesson Two: Episode Thirty-three, so *this* had to have an alternate meaning. Perhaps *this* referred to Alex deciding which chords would accompany the motifs.

Mapping of resources available for communication.

The framing of Episode Five begins with Alex's preceding modal prompt, followed by an in-depth analysis of the six modes and their resources of modes that contributed to this episode. The computer's integrated webcam and separate side camera provided a visual representation for analysis. The mapping is temporal and framed in increments of seconds, for example 04:49 represents 4 minutes and 49 seconds.

Preceding Modal Prompt [Lesson 3 Episode 5] Ollie mouse movement + action qwerty Alex head turn and gaze + speech (how we gonna do this?) then action headphones								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
04:49 (21)			Alex putting headphones on Ollie qwerty and mouse	Ollie moving mouse	Ollie focused on monitor Alex looking downwards			

04:50			Alex secures headphones Ollie qwerty and mouse	Ollie moving mouse	Ollie focused on monitor Alex looking downwards			
04:51			Alex places fingers over keyboard keys	Ollie hand over mouse Alex's head resting fist	Ollie focused on monitor Alex looking downwards at keyboard		Ollie removes left hand from qwerty Alex's left elbow leaning on desk, head resting fist	Both have headphones on, no sound
04:52				Alex's left unclenched fist partially resting over mouth (relaxed)	Ollie focused on monitor Alex looking downwards at keyboard		Alex moves left hand Ollie removes hand from mouse	Both have headphones on, no sound
04:53			Alex plays keyboard	Alex's left unclenched fist partially resting over mouth (relaxed)	Ollie focused on monitor Alex glances upwards and right at monitor		Ollie clasps hands together and leans them against the desk	Both have headphones on, no sound

04:54			Alex plays keyboard	Alex's left unclenched fist partially resting over mouth (relaxed)	Ollie focused on monitor Alex glances upwards and right at monitor			Both have headphones on, no sound
04:55			Alex plays keyboard	Alex's left unclenched fist partially resting over mouth (relaxed)	Ollie focused on monitor Alex looking downwards at keyboard			Both have headphones on, no sound
04:56			Alex plays keyboard	Alex's left hand resting over mouth (relaxed)	Ollie focused on monitor Alex continues looking down at keyboard			Both have headphones on, no sound

04:57			Alex plays keyboard (Am)	Alex's left hand resting over mouth (relaxed)	Ollie focused on monitor Alex continues looking down at keyboard			Both have headphones on, no sound
04:58			Alex plays keyboard	Alex's left hand resting over mouth (relaxed)	Ollie focused on monitor Alex continues looking down at keyboard			Both have headphones on, no sound
04:59			Alex plays keyboard (C maj)	Alex's left hand resting over mouth (relaxed)	Ollie focused on monitor Alex continues looking down at keyboard		Ollie sits back in seat	Both have headphones on, no sound

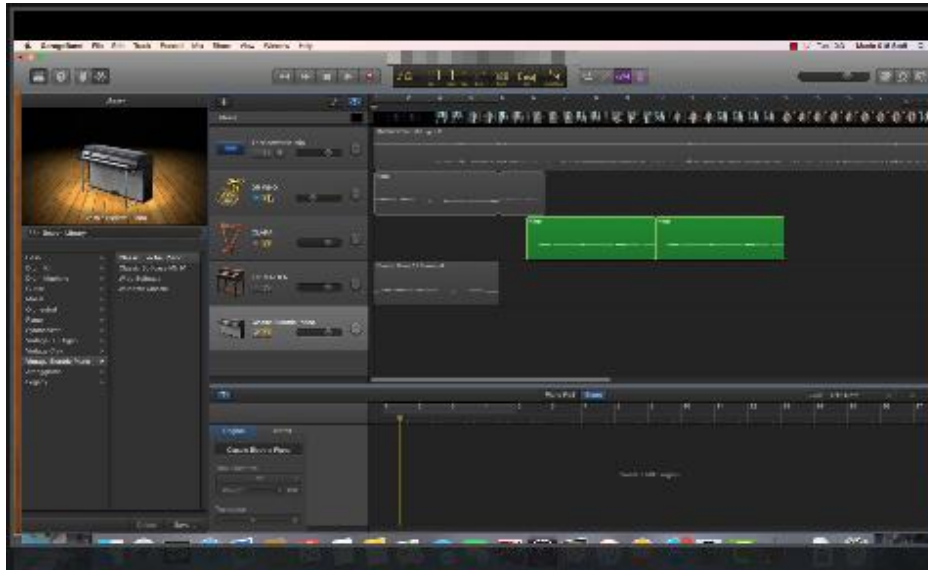
05:00			Alex plays keyboard	Alex's left hand resting over mouth (relaxed)	Ollie glances down at Alex's hand on keyboard Alex continues looking down at keyboard			Both have headphones on, Electric piano chord (G)
05:01			Alex plays keyboard	Alex's left hand resting over mouth (relaxed)	Ollie continues glancing down at Alex's hand on keyboard Alex continues looking down at keyboard			Both have headphones on, Electric piano chord (Am)
05:02			Alex plays keyboard	Alex's left hand resting over mouth (relaxed)	Ollie continues glancing down at Alex's hand on keyboard Alex continues looking down at keyboard			Both have headphones on, Electric piano chord (F)

05:03			Alex plays keyboard	Alex's left hand resting over mouth (relaxed)	Ollie continues glancing down at Alex's hand on keyboard Alex continues looking down at keyboard			Both have headphones on,
05:04			Alex plays keyboard	Alex's left hand moves away from mouth (relaxed) as his head turns slightly	Ollie continues glancing down at Alex's hand on keyboard Alex continues looking down at keyboard			Both have headphones on, Electric piano chord (C)

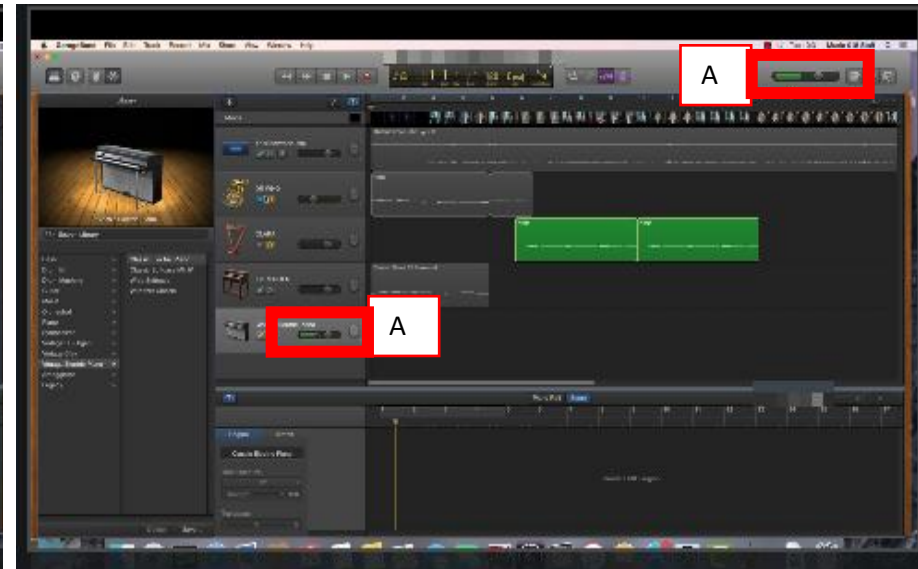
05:05			Alex plays keyboard	Alex's left hand resting on chin (relaxed)	Ollie continues glancing down at Alex's hand on keyboard Alex continues looking down at keyboard			Both have headphones on,
05:06			Alex plays keyboard	Alex's left hand resting on chin (relaxed) Ollie turns his head left and downwards towards Alex	Alex continues looking down at keyboard		Ollie moves hands?	Both have headphones on, Electric piano chord (G)
05:07			Alex plays keyboard	Alex's left hand resting on chin (relaxed)	Ollie returns to looking down at the keyboard Alex continues looking down at keyboard			Both have headphones on, Electric piano chord (Am)

05:08			Alex plays keyboard	Alex's left hand resting on chin (relaxed)	Ollie returns to looking down at the keyboard Alex continues looking down at keyboard			Both have headphones on,
05:09			Alex plays keyboard	Alex's left hand resting on chin (relaxed)	Ollie continues looking down at the keyboard Alex continues looking down at keyboard			Both have headphones on, Electric piano chord (F)
05:10 (21)			Alex removes hand from keyboard	Alex's left hand resting over mouth (relaxed)				Both have headphones on,

Screenshots of Episode Five



04:49 (21) Screenshot of the episode's first frame



05:10 (21) Screenshot of the episode's end frame

There is little difference between the episode's first and last frames. One noticeable point is the episode's end frame which evidences the mode of sound. This sound is indicated on the screenshot by the two areas labelled A. The presence of the mode of sound would suggest that either Alex or Ollie were playing the keyboard and perhaps trying something out. What that something was, was not visible within these two screenshots as nothing further was recorded to the composition.

Interpretation of Episode Five

Episode Five lasted for 21 seconds and found three transformations. The analysis of this episode starts with a brief introduction of the three transformations and then provides a more detailed analysis before summarising the episode.

The first transformation involved both pupils between the preceding modal prompt and 04:52 which encompassed the first four frames. It brought together the pupils' combined modes of gaze, action, gesture and body positioning as they recognised something was about to happen. The next transformation, at 04:53, noted differences in Alex and Ollie's engagement as well as the overall duration of their involvement and choices of modes. For Ollie, the frames included 04:53 to 05:06 whereas Alex's engagement extended to the end of the episode at 05:10. In the second transformation Ollie orchestrated the modes of gaze, sound and gesture whereas Alex orchestrated action, gaze, hand gesture and sound. The pupils' design for learning shared the same outcome but transpired differently. Ollie enacted the third transformation in which he altered his body positioning and focused on his gaze in an attempt to prompt Alex to do something (05:06).

I start the analysis with Alex's preceding modal prompt that provided a rhetorical question emphasising his interest in creating a chordal accompaniment rather than attending to the teacher's pedagogical framing, to add movie markers. Between 04:49 and 04:52, Alex's ensemble of modes illustrated putting on his headphones; placing his left elbow on the desk; starting to rest his head on his left hand; placing his right-hand fingers on the keyboard and focusing his eyes downwards towards the keyboard. Together these actions signalled to Ollie that Alex was preparing to do something. However, at 04:52, the direction of Alex's gaze combined with his unclenched left fist, partially resting over his mouth changed. This shift in modes suggested Alex was still hesitant about how to proceed and these modes ratified his rhetorical question of, *how to do this*, in the episode's preceding modal prompt.

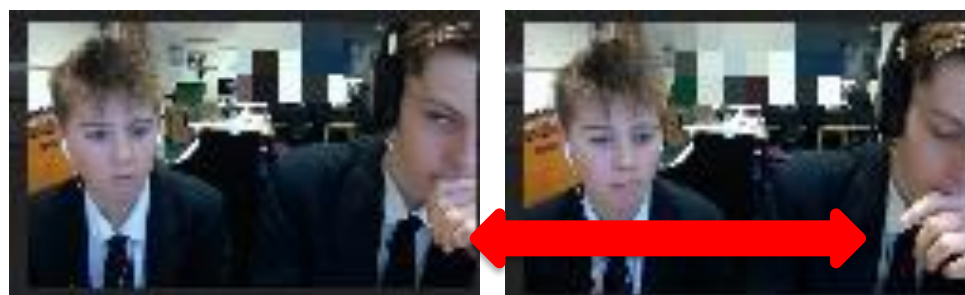
Concurrently, Ollie directed his attention towards the computer screen and with the mouse in his right hand muted three tracks (Dr Who audio, Dr Who motif and the Ice

Governess motif). He then placed his left hand over the QWERTY keyboard. Ollie's actions, gestures and gaze signified two interpretations. First, I interpreted that Ollie attended to the teacher's pedagogical framing as he selected a track to create a movie marker for and second, he communicated this possible compositional starting position to Alex through his mode of action (between 04:49 and 04:51). However, Ollie's signs of communication, in which he visibly directed attention towards Clara's track, had gone unnoticed by Alex.

This first transformation illustrated a difference in the pupils' design for learning. Alex decided to start by focusing on composing chords whereas Ollie muted tracks, thereby effectively suggesting what to attend to such as movie markers or quantisation. These interactions further suggest that both pupils attended to their interests within the composition and misinterpreted each other's signs.

The second transformation (04:53) indicated a variation in the pupils' design for learning. As Alex started to play the keyboard, Ollie simultaneously removed his hands from the QWERTY keyboard and the mouse. Ollie understood Alex's signal as a sign to stop what he was doing. Afterwards, Ollie repositioned himself, leant forward with his hands clasped on the edge of the desk, looked at the computer screen and, with headphones on, listened. The orchestration of these modes showed Ollie's continued engagement with the task. Through foregrounding the modes of gesture and gaze, we can understand the intensity of Ollie's engagement to focus on his partner's musical contribution which became significant to Ollie's design for learning. Next, the analysis attends to Alex in the same transformation who orchestrated different modes, and resources of action and hand gesture.

Figure 5.8 shows Alex's hand gesture which led to the significance of his design for learning. The second transformation (04:53) showed Alex leaning on the desk with his left elbow and resting his head in his hand which was formed by an unclenched fist-shape that partially covered his mouth. The suggested interpretation shows Alex was contemplating as if he was still internalising his thoughts. We know this as no sound was generated which was reflected on the mapping. Instead, Alex moved his fingers over the keys continuing to signify his thoughts.



04:53

04:56

Figure 5.8: Screenshot taken from Lesson Three – Alex’s transformation of resources to design for learning shown through the modes of gesture and gaze

The subtle change in Alex’s resources of modes (predominantly gaze and gesture) at 04:56 provides a hypothetical recovery of meaning. In this instance, his fingers relaxed, as shown through the spacing of the fingers. The gesture and interaction translated to Alex having finalised the chord progression on the keyboard and I interpreted it as Alex having developed his musical ideas. With more confidence and clarity of thought, placing his fingers over the notes became actual playing (testing out chords). At 05:00, the materialisation of the aforementioned silent playing became evident. Alex replayed the chordal pattern in a higher pitch. Here the modes of sound and action became foregrounded which supported Alex’s previous interests in testing out several chordal patterns. Thereby, Alex solidified his musical ideas and moved the composition forward.

My interpretation of the episode’s last transformation (05:06) shows Alex's and Ollie's design for learning partially materialised. Ollie changed the position of his gaze and directed this towards his partner. The staring was intended to interrupt Alex, almost as if Ollie wanted to move closer to the keyboard and copy the chordal patterns Alex had played. However, nothing further transformed from the communication as Alex ignored Ollie’s prompt. This means that we have a partial representation of Ollie’s learning as an intention to replicate the chordal pattern as the materialisation did not fully occur until after the episode finished. I know this as Camtasia shows that immediately after the episode ended, Ollie moved forward and tried to replicate the same chordal pattern. The orchestration of modes and their resources included Ollie sitting back and watching his partner compose whilst listening. More specifically, Ollie

was focused on the visual positioning of Alex's hand on the keyboard along with the sound it created. My interpretation of these interactions supported Ollie's design for learning.

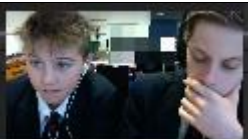
To summarise, Episode Five signified differences in the pupils' design for learning through three transformations which further suggested that each pupil had a designated compositional role.

5.4.2 Episode Ten

The selection of this tenth episode was representative in the way that the preceding modal prompt set the precedence for the pupils' communication. Without having any assumptions on the orchestration of modes, the mode of action seemed to be continuous throughout this instance of non-verbal communication. This stood out to me as being significant in some way. I wanted to examine the salience of the seemingly invisible transformations by questioning what (if anything) the pupils were attending to.

Mapping of resources available for communication.

Preceding Modal Prompt [Lesson 3 Episode 10] Ollie comment (<i>it's quite hard isn't it?</i>) + action keyboard Alex action playing keyboard and gaze								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
07:29 (05)			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Alex gazes right at Ollie playing the keyboard Ollie focused on keyboard		Alex's left elbow on desk with shoulders leaning left. Ollie sits parallel to Alex, close to desk head down	Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (F)

07:30			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Ollie looks up at monitor. Alex remains looking downwards		Ollie's head raises	Both have headphones on Ollie: Electric piano - high pitched melody
07:31			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Ollie looks up at monitor; Alex remains looking downwards			Both have headphones on Ollie: Electric piano - high pitched melody
07:32			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Ollie looks up at monitor; Alex remains looking downwards			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (Am)

07:33			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Ollie looks down towards keyboard; Alex remains looking downwards		Ollie turns head right and slightly downwards	Both have headphones on Ollie: Electric piano - high pitched melody
07:34			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (C)
07:35			Ollie playing the keyboard Alex's right hand over different keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody

07:36			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (G7)
07:37			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody

07:38			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (C)
07:39			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (Fmaj/B)

07:40			Ollie playing the keyboard Alex's right hand over different keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody
07:41			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (G)
07:42			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody

07:43			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody
07:44			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (Am)
07:45			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Both pupils gaze is focused on keyboard			Both have headphones on Ollie: Electric piano - high pitched melody

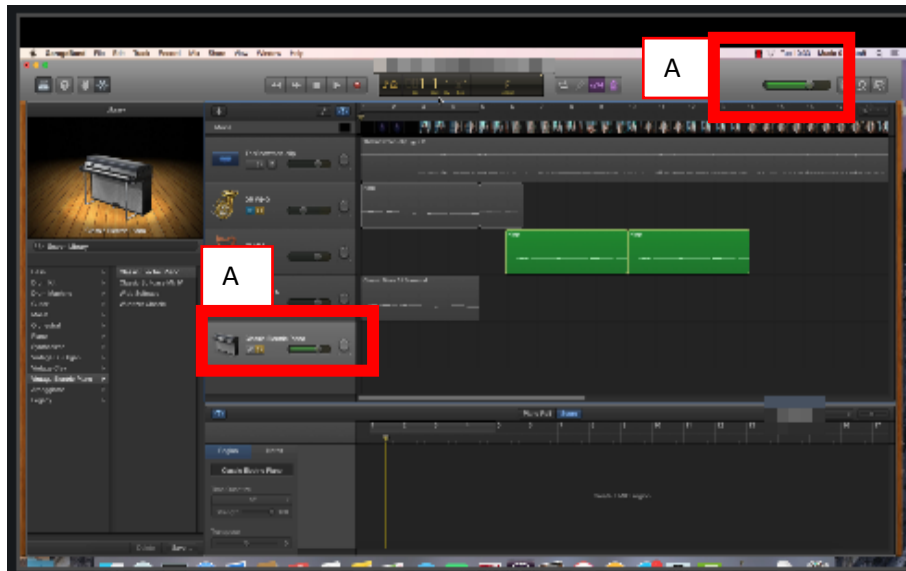
07:46			Both pupils are playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking downwards at keyboard; Alex raises gaze to monitor			Both have headphones on Ollie: Electric piano - high pitched melody Alex: Electric piano chord (F)
07:47			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at keyboard; Alex looks at the monitor			Both have headphones on Ollie: Electric piano - high pitched melody
07:48			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at keyboard; Alex looks at the monitor			Both have headphones on Ollie: Electric piano - high pitched melody

07:49			Ollie playing the keyboard Alex's right hand over keyboard keys, not playing	Alex's left hand resting covering mouth, thumb on cheek	Ollie continues looking at keyboard; Alex looks at the monitor			Both have headphones on Ollie: Electric piano - high pitched melody
07:50			Ollie playing the keyboard Alex qwerty - play function	Alex's left hand resting covering mouth, thumb on cheek; right hand rests above keys on keyboard	Ollie continues looking at keyboard; Alex looks at the monitor			Both have headphones on Ollie: Electric piano - high pitched melody
07:51			Ollie playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek; right hand rests above keys on keyboard	Ollie continues looking at keyboard; Alex glances at the keyboard			Both have headphones on Ollie: Electric piano - high pitched melody

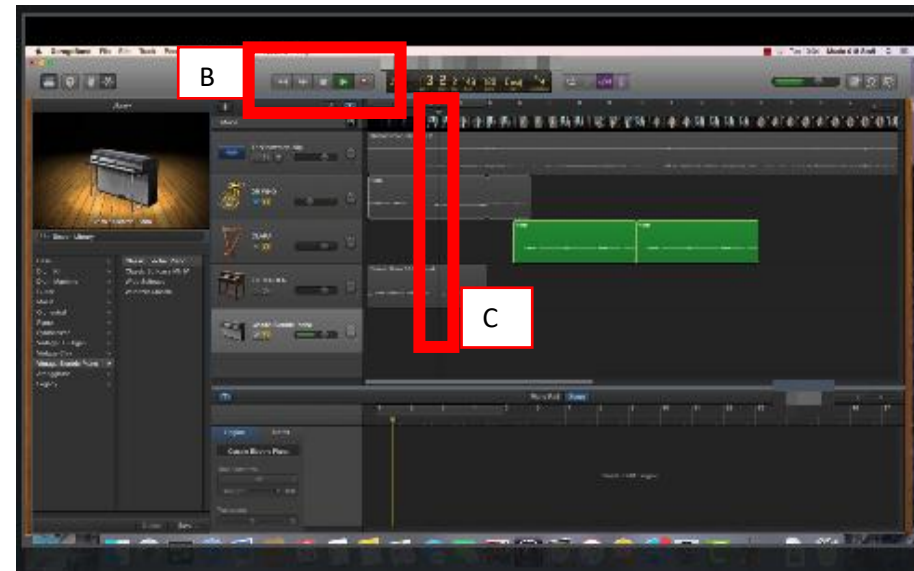
07:52			Ollie playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek; right hand rests above keys on keyboard	Ollie continues looking at keyboard; Alex glances at Ollie			Both have headphones on Ollie: Electric piano - high pitched melody
07:53			Ollie playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek; right hand rests above keys on keyboard	Ollie glances towards partner; Alex looks at the monitor			Both have headphones on Ollie: Electric piano - high pitched melody
07:54			Ollie playing the keyboard	Alex's left hand resting covering mouth, thumb on cheek; right hand rests above keys on keyboard	Ollie returns focus to the keyboard; Alex glances at his partner			Both have headphones on Ollie: Electric piano - high pitched melody

07:55			Ollie playing the keyboard	Ollie turns his head left Alex's left hand resting covering mouth, thumb on cheek; right hand rests above keys on keyboard	Ollie looks at Alex			Both have headphones on Ollie: Electric piano - high pitched melody
07:55 (12)			Ollie stops playing keyboard	Ollie turns his head left Alex's left hand resting covering mouth, thumb on cheek	Ollie looks at Alex		Removes right hand from the keyboard	Both have headphones on no sound

Screenshots of Episode Ten



07:29 (05) Screenshot of the episode's first frame



07:55 (12) Screenshot of the episode's end frame

The first and end frames indicated the presence of the mode of sound. However, the resources that produced the sound were different. The first screenshot suggests that one or both pupils played the keyboard (A). In contrast, the end screenshot showed the software programme played something back (B and C). The play function was highlighted by the change in colour of the play button from grey to green (B). The vertical timeline indicator (C) referenced the position or point in the composition that was audible. From the screenshots alone, it is somewhat difficult to pinpoint the pupils' compositional focus, and the interpretation will examine what occurred.

Interpretation of Episode Ten

The duration of this episode was 26 seconds. Episode Ten started with the preceding modal prompt of the pupils' continuous keyboard playing which became ratified as the episode progressed. The orchestration of modes rarely digressed from action, sound and gaze suggesting both pupils consistently enacted these three modes. The analysis recognised that the resources of modes differed between Alex and Ollie, meaning their learning also differed. This means that between 07:29 and 07:50 there were a number of smaller adaptations to the resources of modes which provides further information to what happened in their learning. The different interpretations of these smaller adaptations became visible during this episode and are therefore discussed in this section. As the episode progressed, Alex's choice of resources instigated a transformation for both pupils from 07:50 to 07:55. Alex and Ollie foregrounded gaze, with its direction, as a means to communicate a new sign of learning.

The episode opened with both pupils playing the keyboard. A reasonable interpretation suggests the pupils continued to compose as they simultaneously played the keyboard. Their mode of action and gaze aligned with my former teaching experiences and expectations of what composing at a MIDI keyboard resembles. Ollie played a piece of music in a high pitch, at the top end of the keyboard, using the classic electric piano sound. Alex continued 'trying out chords' in a mid-range octave. At 07:29 there was a failed attempt at communication between the two pupils. Alex chose the mode of gaze and its directionality towards Ollie as a means to communicate and gain Ollie's attention. Ollie continued to play the keyboard and thereby ignored Alex.

Over the first 21 frames of Episode Ten (07:29 to 07:50), further differences in the resources of modes between Alex and Ollie were analysed, with more differences observed for Alex than for Ollie. I start the discussion of my findings with interpretations for Ollie and then move to Alex.

At 07:29, the transcript noted that Ollie sat parallel to Alex, close to the desk with his head (and gaze) focused downward on the keyboard. He continued to maintain the same ensemble of modes of action, sound and gaze, with little variation. Ollie raised his

head once and looked at the computer screen before diverting his attention back to the positioning of his hand on the keyboard as he played. It was clear that Ollie looked at the computer screen to establish what Alex was doing as this was a fleeting moment. What was less notable was Ollie's reaction in response to Alex starting the playback function (07:50) which showed that Ollie continued to play the keyboard for a further three seconds.

The analysis of the same 21 frames (07:29 to 07:50) offers a contrasting perspective from Alex who orchestrated the modes of gaze, gesture and action. Sound was intermittent and often as a result of the mode of action. Two interpretations of Alex's communication became visible through the different foregrounded modes of gesture and gaze, then the modes of action and sound.

Alex's left hand rested over his mouth, with his thumb on his cheek, and his left elbow leaning on the desk to support his gesture. His gaze focused downward on the keyboard and his playing. The features of the resources for Alex's gesture and gaze suggested he was contemplating the next part of the composition. The placement of his left hand was consistent with how we have previously seen Alex respond to his decision-making process which was often interspersed with glances at the computer screen, or his partner. Again, the implication of the sign at 07:50 suggested that Alex wanted Ollie to stop playing, almost as if Ollie's playing was a distraction. Maybe Alex simply wanted Ollie to contribute something that he felt was more relevant to their composition.

Next, I consider Alex's modes of sound and action for the same duration of time between 07:29 and 07:50. Mentioned earlier, the sound produced by Alex was intermittent. The transcript showed moments where Alex played a chord (e.g. 07:39) which was then followed by his right hand resting over different MIDI keyboard keys, not pressing or playing (e.g. 07:40). My interpretation of this isolated action recognised time was needed to relocate his hand position, from one chord to the next. We know from previous episodes that Alex can fluidly combine and play a chord progression. Thereby, by isolating the modes of gesture and gaze, we can uncover an alternate representation of Alex's learning design, specifically Alex taking the time to decide which chords, or their progression, would best fit and accompany the motifs.

The analysis and the transcript both showed that Alex's design for learning started to change from 07:46 as he foregrounded the mode of gaze and alternated the directionality between the computer screen, Ollie and his finger positioning on the keyboard. I was unable to determine which specific visual aspect of the computer screen or of the software Alex focused upon meaning that my interpretation of Alex's gaze could only provide a partial meaning. However, these signs of learning suggested that Alex was thinking about how to proceed and at 07:50 Alex signified a transformation of resources which evidenced the modes of action and gaze. The transformation showed Alex's right hand moved from the MIDI keyboard to the QWERTY keyboard, he tapped the spacebar and then repositioned over the MIDI keyboard's keys. The interaction showed Alex wanted to assess whether the chords would fit the rest of the composition.

Figure 5.9 evidences the subtle changes in Alex's hand gesture at 07:46 and 07:50. The first frame represents Alex's left hand, relaxed with fingers spaced out, whereas the second frame shows bent fingers, tightening the hand muscles.

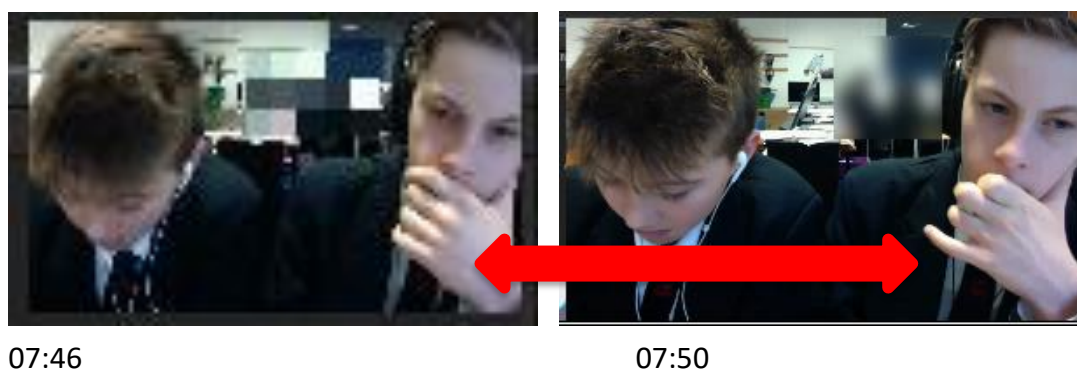


Figure 5.9: Screenshot taken from Lesson Three: Episode Ten – Alex responding to pressure

Examining the tension of the hand and the bent fingers in the second frame (Fig 5.9), I interpreted this moment of added pressure. Whether the pressure was owing to the continuation of Ollie playing the keyboard, being unable to hear the playback fully, or as an expression of frustration, Alex was beginning to show signs of restriction in moving his design for learning forward.

From the positioning of Alex's eyes and his hands (Fig 5.9), I argue that he was listening to something in his head. The something here refers to trial-and-error composing in his thoughts. Another earlier interpretation of a similar interaction reminds us that Alex's prompt may have been purposeful and intended to attract Ollie's attention. During the composition playback, Ollie directed his gaze at Alex. They exchanged glances that could have communicated, 'What's next?'

Nonetheless, Ollie returned to the same ensemble of modes of action, gaze, positioning and sound. As Ollie continued to play the keyboard, it could have been interpreted as a means to annoy Alex or to relieve some perceived boredom. The communication suggested a moment of awkwardness between them. However, as Alex contributed towards the compositional outcome, he intended to assert his control or dominance, evidenced by his taking the lead in playing the keyboard.

To summarise, the preceding modal prompt of the pupils' actions in playing the keyboard was ratified throughout the episode. Alex tried out different chords, whereas Ollie continuously played the same melody. Communication was evident from (and between) both pupils, but I found that no significant meaning-making occurred. The first sign was at 07:29, in what I have termed as a failed attempt at communication by Alex. The second was a more successful sign of communication at 07:50, in which Alex transformed his resources to playback the recording despite Ollie taking another three seconds to engage and respond to the sign.

For Alex, communication and his design for learning partially materialised. However, no musical learning was recorded on GarageBand during the episode, as shown in the end screenshot at 07:55. Within the analysis of the episode, I would argue that the transformation Alex instigated at 07:50 did not come to fruition.

5.4.3 Episode Eighteen

Almost seven minutes passed after Episode Ten, during which three minutes were teacher-directed in the form of an input. The pupils were instructed on how to construct and add a chordal pattern to support their motifs. They were reminded of the lesson's

expectation and to complete the composition of all three motifs. Prior to the beginning of Episode Eighteen, the pupils appeared to work together, focused on editing and refining their different tracks.

The preceding modal prompt for this episode was the outcome of a cause-and-effect interaction. Alex played a chord on the keyboard that provoked an immediate verbal response from Ollie. In Ollie's reaction, the modes of body movement, gaze and facial expression coincided and led to his verbal approval of the musical sound with the phrase, 'That sounds really evil.' Coordinated with the sound produced by Alex's action on the keyboard, Ollie smiled and sat in an upright position. Ollie's interaction emphasised his excitement. At the very least, Ollie expressed his eagerness for Alex to pursue the musical sound he had heard. Through his body language, Ollie also demonstrated his commitment to its development.

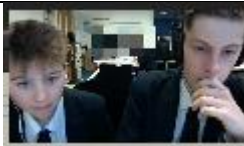
Mapping of resources available for communication

Preceding Modal Prompt [Lesson 3 Episode 18]

Alex sound produced by action keyboard

Ollie verbal acceptance (*That sounds really evil*), gaze, facial expression and position

Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
15:25 (12)			Alex playing keyboard with left hand	Ollie places hand over keys on keyboard	Both looking at monitor	Ollie smiles	Ollie sat upright Alex leaning slightly left as elbow on desk	Both have headphones on no sound
15:26				Ollie keeps hand over keys on keyboard	Ollie glances down at keyboard	Ollie smiles	Ollie leans forward	Both have headphones on [click]

15:27			Alex playing keyboard right hand	Ollie keeps hand over keys on keyboard Alex left hand clenched	Ollie glances down at keyboard Alex glances at fingers on keyboard	Ollie smiles		Both have headphones on [click]
15:28			Alex playing chord on keyboard	Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed)	Both looking at monitor			Both have headphones on [click, click] low pitched woodwind chord [FAC]
15:29			Alex playing chord on keyboard	Ollie keeps hand over keys on keyboard Alex's left hand partially resting over mouth (relaxed)				Both have headphones on low pitched woodwind chord sustained

15:30			Alex playing chord on keyboard	Ollie keeps hand over keys on keyboard	Ollie glances downwards at monitor as he moves head down		Alex's right hand moves to keyboard positioned under left hand	Both have headphones on low pitched woodwind chord sustained
15:31			Alex playing chord on keyboard	Ollie keeps hand over keys on keyboard	Ollie glances downwards at Alex's hands on keyboard		Alex's right hand remains positioned under left hand	Both have headphones on low pitched woodwind chord sustained
15:32			Alex playing chord on keyboard	Ollie keeps hand over keys on keyboard	Alex looks at hand position on keyboard		Alex's right hand remains positioned under left hand	Both have headphones on low pitched woodwind chord sustained

15:33			Alex playing chord on keyboard	Ollie keeps hand over keys on keyboard	Alex continues to look at hand position on keyboard Ollie's gaze raises back to monitor		Alex's left hand moves away from the keyboard	Both have headphones on low pitched woodwind chord sustained
15:34				Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed)	Both looking at monitor			Both have headphones on French horn Dr (<i>I never know why</i>)
15:35				Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed)	Both looking at monitor			Both have headphones on French horn Dr (<i>I only know</i>)

15:36				Ollie keeps hand over keys on keyboard Alex's left hand partially resting over mouth (relaxed)	Both looking at monitor; Alex tilts head right			Both have headphones on French horn Dr (<i>who</i>)
15:37				Ollie keeps hand over keys on keyboard Alex's left hand resting on cheek (relaxed)				Both have headphones on

15:38			Ollie qwerty - stop function	Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed)	Both looking at monitor; Alex tilts head left			Both have headphones on Harp motif starts
15:39			Ollie qwerty - start function	Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed)				Both have headphones on Harp motif
15:40				Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed)	Both looking at monitor			Both have headphones on Harp motif

15:41			Ollie qwerty	Ollie keeps hand over keys on keyboard Alex's left hand partially resting over mouth (relaxed)	Both looking at monitor; Alex's head tilts right			Both have headphones on Harp motif
15:42				Ollie keeps hand over keys on keyboard Alex's left hand partially resting over mouth (relaxed)	Both looking at monitor			Both have headphones on Harp motif

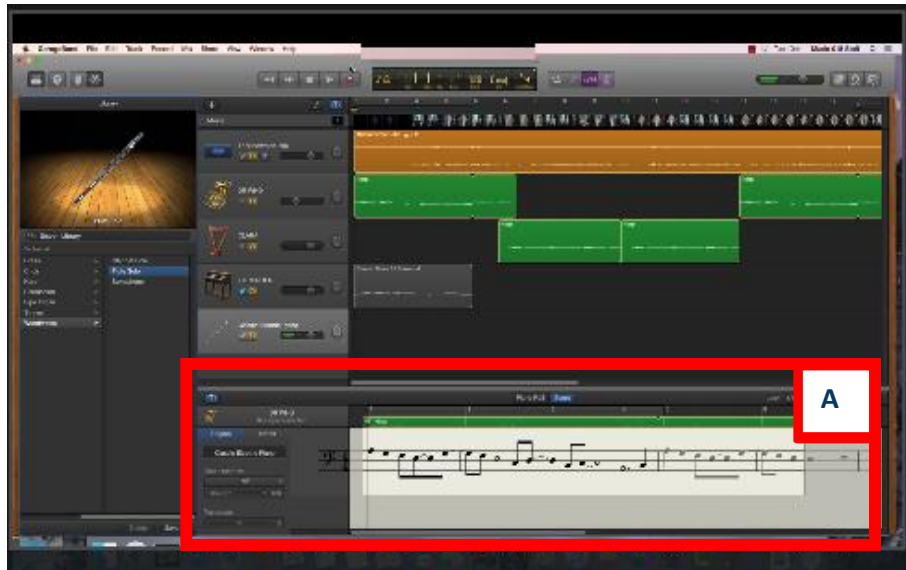
15:43				Ollie keeps hand over keys on keyboard Alex's left hand moves away from mouth as head rises;	Ollie looking at monitor Alex glances left and downwards		Alex right arm extends towards mouse	Both have headphones on
15:44			Alex qwerty - start function	Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed); head lowers	Both looking at monitor		Alex right arm retracts towards qwerty	Both have headphones on low pitched woodwind chord brass motif

15:45				Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed); right fist clenched	Both looking at monitor			Both have headphones on low pitched woodwind chord brass motif
15:46				Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed); right fist clenched	Both looking at monitor			Both have headphones on low pitched woodwind chord brass motif

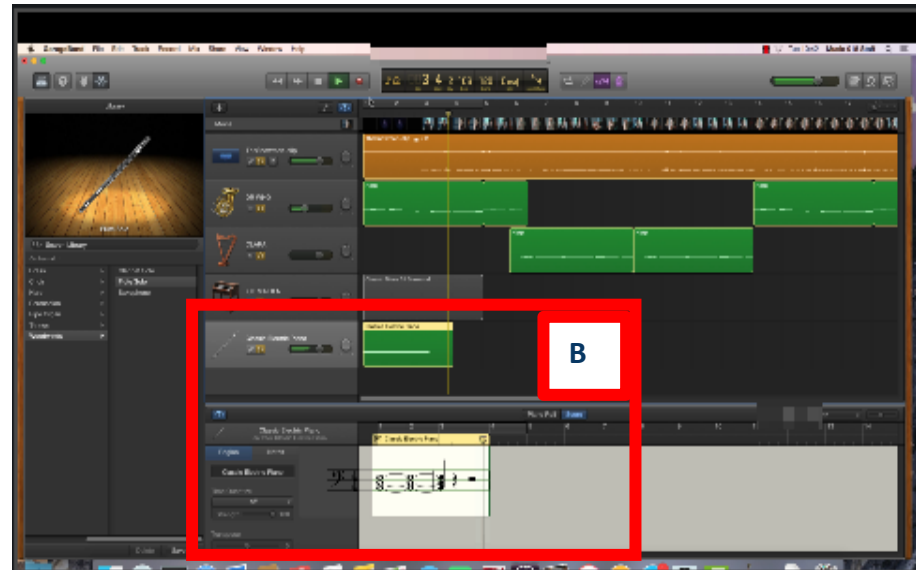
15:47				Ollie keeps hand over keys on keyboard Alex's left hand resting over mouth (relaxed); right clenched fist	Both looking at monitor			Both have headphones on low pitched woodwind chord brass motif
15:48				Ollie removes hand from keyboard Alex's left hand (relaxed) moves away from mouth as head rises; right hand on mouse				Both have headphones on low pitched woodwind chord

15:49				Alex's left hand resting over mouth (relaxed); right hand flicks Ollie's hand out of way then places his on mouse	Both looking at monitor Ollie's head tilts left			Both have headphones on brass motif <i>Dr (I never know)</i>
15:49 (21)					Both looking at monitor			

Screenshots of Episode Eighteen



15:25 (12) Screenshot of the episode's first frame



15:49 (21) Screenshot of the episode's end frame

In comparing the two screenshots, the first screenshot shows the score function with a melody (A), whereas the end screenshot shows the addition of a recorded track (B). The score function (A) displays a melody line using simple rhythms, suggesting that the pupils used the score function to quantise one of their motifs, as requested by the teacher in Lesson Two Episode Fifteen. Quantisation adjusts the recorded melody to align more closely with the composition's tempo. In the end screenshot (B), chords have been used, likely representing the background music. The track represents chords, as the score function shows three notes played together simultaneously, which corresponds with the definition of a chord. The pupils' use of chords

further connects to the teacher's pedagogical framing to include background music. The end screenshot indicates the track's playback, evidenced by the illuminated green play button and the yellow vertical timeline indicator moving across the tracks.

Interpretation of Episode Eighteen

The episode illustrates that both pupils attended to a recording of a chordal pattern followed by reviewing and editing the recorded track. Recording and editing are two separate activities that have a remote point of reference to the teacher's pedagogical framing. The recording activity took place between 15:25 and 15:37. The reviewing and editing took place from 15:40 to 15:49. In between these two activities, at 15:38 and 15:39, a transformation of resources occurred. Although each activity is reported separately, I recognise that they are a part of the whole instance of non-verbal communication.

The transcript provided unambiguous evidence of the mode of sound as four consecutive clicks, shown by the word click, across three frames from 15:26 to 15:28. These signalled the beginning of the recording activity where Alex orchestrated the modes of action, gaze and sound as well as momentarily adding a hand gesture. The mode of action (playing the keyboard) became prominent for Alex. Ollie orchestrated the modes of body positioning, gaze, facial expression and sound. The modes of sound and facial expression were foregrounded in Ollie's interaction, reflecting his earlier interests from the preceding modal prompt.

At 15:28, I recognised that Alex's left-hand gesture rested partially over his mouth in a relaxed manner and signified a brief moment of thought and of 'something being enacted.' Alex's gesture changed at 15:30 when he positioned his right hand underneath his left hand on the keyboard to sustain the sound of the chord or to change chords without interrupting the flow of sound. Within the same sequence of time, Ollie sat closer to the desk, leant forward, glanced at Alex's hand position on the keyboard and smiled. Ollie was synchronously engaged with Alex's interactions as his gaze fluctuated upward at the computer screen and downward towards his partner's hands on the keyboard, all whilst listening to the sound being produced. It was clear from Ollie's seating position, close to the desk with his head slightly bowed, that he was engaged and listening. A further sign that ratified Ollie's attentiveness included listening as he mouthed the word 'Who' in time with the audio track (15:36).

A transformation of resources started at 15:34. We know this as Alex raised his head and tilted it in Ollie's direction. In addition, there was a change in Alex's left-hand gesture. He removed his hand from the keyboard, placed his left elbow on the desk, and rested his hand (in a relaxed manner) covering his mouth. This action signalled Ollie to stop the recording (15:38) and further communicated that Alex was seeking approval for the recording. As a sign of approval, Ollie used the QWERTY keyboard, tapped the spacebar and replayed the recorded track (15:39).

Reviewing and editing commenced at 15:40 until 15:49 when Alex and Ollie orchestrated the modes of gesture, gaze and sound. The mapping clearly showed that both pupils foregrounded the modes of gaze and sound but featured different resources within those modes. Their focus was sustained and directed at the computer screen with headphones on, suggesting they were engaged in reviewing one of the tracks. The episode's screenshot of the end frame suggested the pupils listened to the bassoon track as the track was highlighted, although the mapping identified the harp sound. This difference can be theoretically explained by the pupils' interests in what they wanted to attend to within the composition. Ollie placed his right hand over the keys on the keyboard without pressing down or playing them and sustained this hovering position from 15:40 until 15:48. As Ollie removed his hand from the top end of the keyboard, he started to move the mouse and its cursor. This action signified that Ollie was searching for something in the composition playback. However, Alex took his right hand and flicked Ollie's hand off the mouse and out of the way. This short two-second transformation of resources (15:48 and 15:49) communicated two points. The first point suggested that Ollie was to stop refining the composition. The interpretation of this communication also signified the second point, that Alex was in control.

In summary, Episode Eighteen lasted for 24 seconds. The episode evidenced two compositional activities: recording and reviewing and/or editing. The pupils' design for learning showed they had negotiated their compositional intentions through their control of different semiotic actions, e.g. Alex recorded the motif, and Ollie directed the editing. However, at 15:48, I argue that Alex's interactions impeded Ollie's learning. Although Alex acknowledged Ollie's communication, he refused to allow him to enact his musical ideas.

5.4.4 Episode Twenty-five

Four minutes passed between Episodes Eighteen and Twenty-five, in which the pupils continued to review, edit and refine their composition. In the lead up to Episode Twenty-five, Alex and Ollie changed the compositional activity from editing to locating and adding in movie markers. Episode Twenty-five illustrates that both pupils attended to the teacher's pedagogical framing to locate and identify movie markers. From Lesson Three, this episode is the last to be analysed .

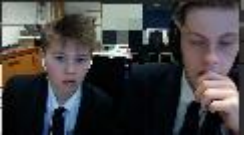
The preceding modal prompt highlighted that Ollie used the mouse to mute different tracks whilst trying to keep up with Alex, who pointed at the computer screen. It was clear that Alex's gesture gave Ollie instructions on which tracks to mute. Ollie's utterance of, '*Whoa, whoa, wait.*' was a direct signal for Alex to stop and/or slow down whilst he isolated the required track for them to work on.

Mapping of resources available for communication.

Preceding Modal Prompt [Lesson 3 Episode 25]								
Ollie pointing with mouse muting musical tracks + speech (<i>whoa, whoa, wait</i>)								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
19:48 (09)			Ollie using mouse - [clicking] muting Ice Maiden tracks	Alex's left unclenched fist partially resting over mouth (relaxed)	Ollie looks at the monitor Alex glances left		Alex rests left elbow on desk leaning slightly to his left Ollie is sat back in his seat away from the desk (behind Alex) but in close proximity	Both have headphones on no sound

19:49			Ollie using mouse - [clicking] muting tracks	Alex's left unclenched fist resting over mouth	Ollie continues to look at the monitor Alex glances down			Both have headphones on no sound
19:50			Ollie using mouse - [clicking] muting tracks	Alex's left unclenched fist resting over mouth	Ollie continues to look at the monitor Alex looks at monitor			Both have headphones on no sound
19:51			Ollie using mouse - [clicking] muting Clara track Alex qwerty - play function	Alex's left unclenched fist resting over mouth	Ollie continues to look at the monitor Alex continues to look at monitor			Both have headphones on no sound

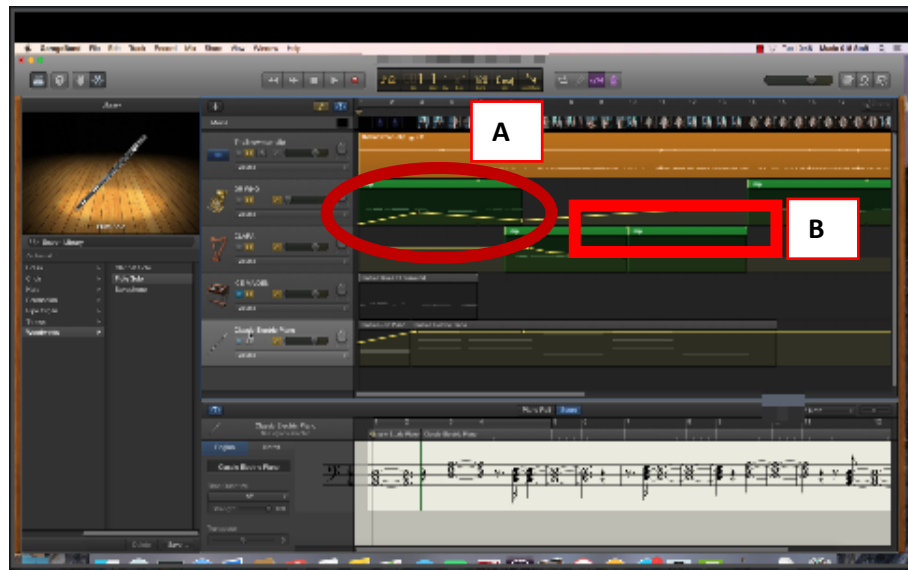
19:52			Ollie using mouse - [clicking] muting Dr Who track	Alex's left unclenched fist resting over mouth	Ollie continues to look at the monitor Alex continues to look at monitor			Both have headphones on no sound
19:53				Ollie using mouse Alex's left unclenched fist resting over mouth	Ollie continues to look at the monitor Alex continues to look at monitor			Both have headphones on no sound

19:54				Ollie using mouse Alex's left unclenched fist resting over mouth	Ollie continues to look at the monitor Alex continues to look at monitor			Both have headphones on no sound
19:55				Ollie using mouse Alex's left unclenched fist resting over mouth	Ollie gazes left			Both have headphones on no sound
19:56				Ollie using mouse Alex's left unclenched fist opening up	Alex continues to look at monitor but glances to his right		Ollie moves further back Alex begins to sit upright	Both have headphones on no sound

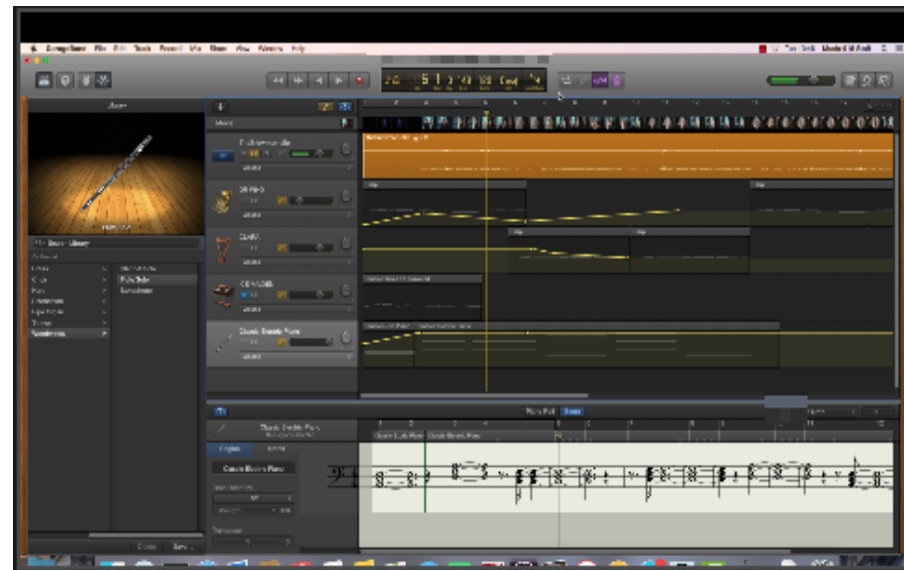
19:57				Ollie using mouse; left arm extends towards qwerty Alex's left hand open with thumb resting on chin and finger on cheek	Ollie gazes downwards at qwerty		Ollie sits upright Alex sits back from desk - shifting shoulders	Both have headphones on Dr Who (<i>I never</i>)
19:58				Ollie using mouse; left hand on qwerty Alex's left unclenched fist resting partially over mouth	Ollie looks at the monitor Alex continues to look at monitor but glances to his right		Ollie moves closer to the desk Alex leans closer to the desk (left)	Both have headphones on Dr Who (<i>why,</i>)

19:59				Ollie using mouse; left hand on qwerty Alex's left unclenched fist resting partially over mouth	Ollie continues to look at the monitor Alex continues to look at monitor			Both have headphones on Dr Who (<i>I only know</i>)
20:00			Ollie qwerty - stop function	Ollie using mouse; left hand on qwerty Alex's left unclenched fist resting partially over mouth	Ollie continues to look at the monitor Alex continues to look at monitor			Both have headphones on Dr Who (<i>who</i>)
20:01 (06)				Alex's hand moves away from face	Ollie continues to look at the monitor Alex continues to look at monitor		Ollie sits back in his seat	Both have headphones on no sound

Screenshots of Episode Twenty-five



19:48 (09) Screenshot of the episode's first frame



20:01 (06) Screenshot of the episode's end frame

The first screenshot shows the pupils at the beginning of their composition. The score function was open and showed the notation for the backing track. Muted was the Ice Governess' track, indicated by the headphone symbol, coloured blue with a line through. The audibly available tracks were Doctor Who, Clara and the clips audio track. Furthermore, the editing function was enabled within the software's master track. Label A shows yellow dashes and lines representing dynamics. Also, we can determine which track is being edited by the green bar on the top of the track, as shown by Label B. In contrast, the screenshot at 20:01 showed some development, as the vertical timeline indicator (cursor) had moved horizontally across the

composition to play the unmuted tracks. This movement suggests that the pupils were searching for something specific. However, the exact nature of their search cannot be determined solely from the screenshots.

Interpretation of Episode Twenty-five

The duration of the episode was 13 seconds. In the episode's analysis and interpretation, I identified that the preceding modal prompt of muting tracks was ratified. The analysis suggested the pupils now attended to the teacher's pedagogical framing of adding movie markers, as had been suggested to the class much earlier in the lesson (between 11:15 and 14:30).

Within the first five seconds of this episode (19:48 to 19:52), Ollie orchestrated the modes of action and gaze, and his body positioning communicated his engagement and level of focus. Ollie muted three tracks (the Ice Governess, Clara and the Doctor), leaving the audio from the Dr Who clip (BBC, 2012) and the background music track audible. Alex communicated similar signs of engagement and focus but orchestrated different resources of modes of body positioning, gaze and gesture. The transcript showed Alex resting his left elbow on the desk as his left hand formed an unclenched fist shape that partially covered his mouth while he looked at the computer screen.

The pupils' body positioning at the desk had not necessarily been visible in prior episodes, and this new perspective intrigued me as their interaction provided different interpretations of their engagement. Ollie sat back in his seat, away from the desk and behind Alex but still close to him. The transcript appeared to show Ollie as if he were leaning on Alex, but I know from observation this was not the case. Maybe Ollie was comfortable in this position, providing a better vantage point to see what Alex was doing. An alternative interpretation of Ollie's ensemble of modes could suggest that he wanted to take control of finding and adding the movie marker.

In contrast, Alex continued to rest his elbow on the desk, leaning slightly to his left and away from Ollie (19:56). Alex was proximally closer to the desk and resources than Ollie. I interpreted Alex's modes of body position and gesture to show control and contemplation rather than him being uncomfortable with Ollie's proximity. Ollie sustained his gaze during the first five seconds of the episode. He looked directly at the computer screen and used the mouse to mute several tracks. Interestingly, although not analysed on the mapping, the integrated camera shows Ollie's mouth slightly open.

This facial expression was first observed in Lesson Two Episode Nine, where it was interpreted as intense engagement. It would be reasonable to assume the same interpretation here.

It was clear that during this moment, the pupils' body positioning and gaze became foregrounded. These two modes provide a clear interpretation of the pupils' engagement in the task and their level of focus. Although the mode of action applied to Ollie, its significance was more about developing the composition, even though it can be seen to communicate his engagement in the task.

Between 19:53 and 19:56, both pupils continued to orchestrate the same modes of body positioning, gesture and gaze (Alex) and action and gaze (Ollie). Ollie's continued use of the mouse suggested that he edited the composition or was still trying to locate a specific point for another movie marker. The following two frames (19:56 and 19:57) noted a brief transformation relevant to both pupils. Ollie's gaze and body positioning altered simultaneously with Alex's changes in body positioning, gaze and gesture. The transformation signalled that the pupils had located a potential movie marker. As such, Ollie adjusted his seating position by sitting further back in his seat, with an almost upright posture and raised head. Ollie's gaze remained consistently at the computer screen level before he glanced to his right and then downward towards the desk. Here, the modes of gaze and gesture (in pointing the mouse) were significant as they suggested he was editing and/or making changes to the composition.

During the same period, Alex made small alterations to the modes of positioning and gesture. At 19:56, Alex began to sit upright with his left hand opening up from its unclenched fist shape. This change was followed by Alex shifting his shoulders backwards and repositioning his left hand in an open position with his thumb resting on his chin. At that moment, Alex's slight changes in the resources of modes communicated to Ollie a sign of approval for his actions. This transformation then introduced a different ensemble of modes.

The significance of this transformation added the mode of sound to the already complex ensemble of modes. It meant that the pupils were able to use the audio and visual cues

of the Dr Who clip (BBC, 2012) to determine whether they had actually located a movie marker. At 20:00, Ollie confirmed this compositional effect by stopping the playback when the audio said, 'Who.' This action clearly signalled to Alex that it was the correct position for a movie marker. At this moment, Ollie's learning materialised, showing his musical understanding as he identified and located where a movie marker could be incorporated.

5.4.5 Summary of Lesson Three

In 23 minutes, there were a total of 28 instances of non-verbal communication. There was an additional teacher input, which lasted for 3 minutes and 15 seconds. This input reduced the pupils' overall compositional time to approximately 20 minutes. The teacher's pedagogical framing was for all pupils to understand the importance of the visual and action points in the film clip and how these identified markers could have been established and embellished in the music score to create a successful composition. The additional teacher inputs, given after Episode Ten and before Episode Eighteen, demonstrated how to choose and add a chord sequence to enhance the motifs. After the demonstration, the pupils received further reinforcement of the task. The teacher's verbal instructions conflicted with the pedagogic framing as the pupils were to, *'Carry on, use your motifs - start with simple ideas.'*

The four episodes analysed lasted for 1 minute and 24 seconds, during which the pupils began by enacting their interests and compositional preferences. By Episode Twenty-five, the pupils were starting to negotiate their differences in their designs for learning and assigned themselves roles within the activities. For example, Alex was focused on the chordal progression in Episodes Five, Ten and Eighteen but worked with Ollie to establish a position to add another movie marker. In contrast, Ollie's orchestration of modes showed that he was following the teacher's initial instructions, as mentioned in Episodes Five and Twenty-five.

The pupils' design for learning was different. Alex tried out different chordal patterns, continued experimenting with various chords and recorded them. Following this, a period of reviewing and editing occurred. Ollie's design for learning was predominately

focused on reviewing and editing the motifs, watching Alex's recording in Episode Eighteen and implementing another movie marker in Episode Twenty-five.

Interestingly, Episode Ten illustrated a failed attempt in non-verbal communication, as Ollie either chose to ignore (or did not see) Alex's prompt at 07:29. Even Alex's second attempt to capture Ollie's attention meant a three-second delay. Two contrasting instances of semiotic action worthy of mentioning emerged during this lesson. The first recognised the preceding modal prompt for Episode Eighteen, in which Alex's *evil-sounding chord* captured Ollie's full enthusiasm, engagement and attention. The second was the limited agency Ollie experienced despite the previous negotiation of compositional roles. In the same episode, Alex controlled Ollie's semiotic actions by removing his hand from the keyboard, thus impeding Ollie's learning design. Episode Twenty-five shows Ollie's design for learning, in which he focuses on finding the exact place to add a movie marker. He did this by taking control and directing Alex.

5.5 Lesson Four – Bringing it Together and Reflection

The section presents the last lesson I observed; however, it was not the final music lesson of the half term. The teacher then instructed the pupils to work in peer groups. This group work limited the selection of instances of non-verbal communication as Ollie and Alex worked with non-participant pupils.

Lesson Context

It was the final lesson of the day, and pupils lined up quietly outside the music classroom. The atmosphere seemed different. Some pupils leant against the wall, some yawned, and others stood with hunched shoulders, eyes towards the ground. Before the pupils entered the music classroom, the teacher gave them firmly worded instructions about the lesson's tasks. Afterwards, Ollie expressed his tiredness and asked whether I felt tired too. As I responded, the teacher sternly repeated, '*Quietly*', and I felt the need to apologise. We all entered in silence and took our places. Alex and Ollie set up their learning space. They plugged in headphones, sat down, faced the centre of the room and awaited further teacher input.

Shortly after registration, the teacher instructed the pupils to look at Moodle (the school's interactive learning tool) to review the task's assessment criteria (Appendix B). Alex and Ollie's gaze appeared focused on the computer screen. Their eye and head movements indicated they were reading the task's assessment text. Ollie pointed towards the computer screen whilst Alex shrugged his shoulders and turned and looked towards another pair of pupils.

5.5.1 Episode Four

This forth episode occurred seven minutes after the start of the lesson. The preceding modal prompt shows Alex moves away from the computer, leaving Ollie sitting on his own.

Mapping of resources available for communication.

Preceding Modal Prompt [Lesson 4 Episode 7]								
Alex movement away from computer								
Time	Integrated Webcam	Side Camera	Action	Pointing/ Gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
07:24 (29)			Right hand fingertips on desk	Ollie rests his elbow on desk with thumb under chin whilst hand is fist like in front of mouth and nose	Ollie gaze at monitor		Alex turns away from desk	Ollie headphones on, no sound

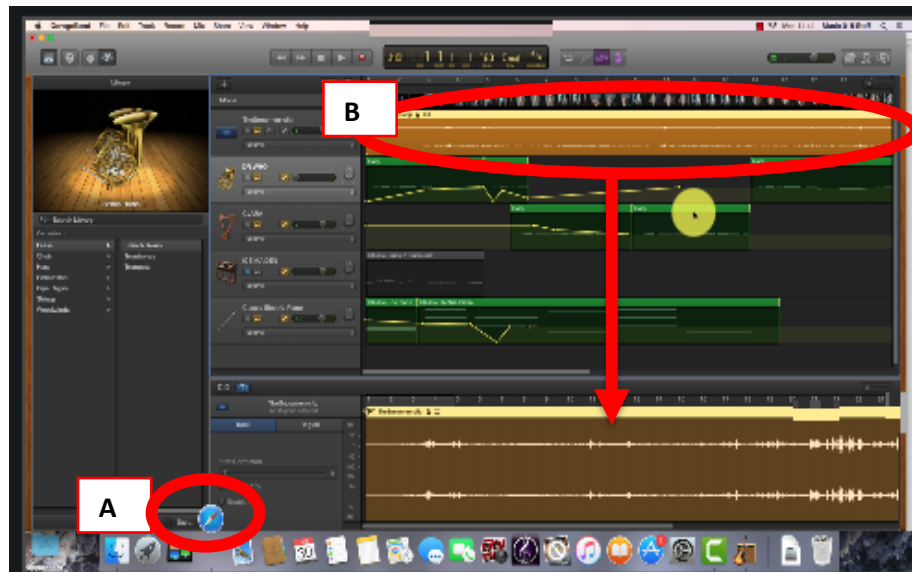
07:25			Right hand fingertips on desk	Ollie rests his elbow on desk with thumb under chin whilst hand is fist like in front of mouth and nose	Ollie gaze at monitor		Alex gets up from chair	Ollie headphones on, no sound
07:26			Right hand fingertips on desk	Ollie rests his elbow on desk with thumb under chin whilst hand is fist like in front of mouth and nose	Ollie gaze at monitor		Alex walks out of view	Ollie headphones on, no sound
07:27			Ollie tapping keyboard	Ollie's hand opens and palm of hand under chin	Ollie head moves right and gazes at right hand on keyboard			Ollie headphones on, no sound

07:28			Ollie continued tapping of keyboard	Ollie head moves down with palm of hand over mouth	Ollie continues gaze downwards			Ollie headphones on, no sound
07:29			Ollie continued tapping of keyboard	Ollie head tilts upwards with palm of hand over chin and mouth	Ollie glances at monitor			Ollie headphones on, no sound
07:30				Ollie head tilts upwards with palm of hand over chin and mouth Ollie reaches for mouse	Ollie glances at monitor			Ollie headphones on, no sound

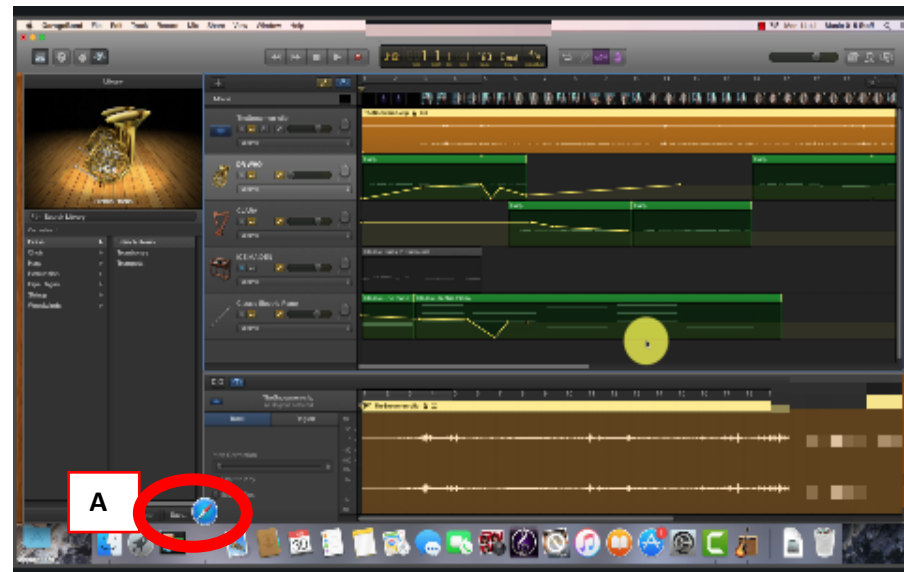
07:31				Ollie head turns left with palm of hand over chin and mouth Ollie moves mouse position to the left	Ollie gazes at monitor (eyes move downwards)			Ollie headphones on, no sound
07:32				Ollie moves mouse position central	Ollie continues to gaze at monitor			Ollie headphones on, no sound
07:33				Ollie's hand over mouse towards Ice Maiden track	Ollie's gaze moves right still focused on monitor			Ollie headphones on, no sound
07:34				Ollie moves mouse over background music track				Ollie headphones on, no sound

07:35				Ollie head tilts upwards with palm of hand on side of face Ollie moves mouse upwards towards Clara track	Ollie's head tilts upwards			Ollie headphones on, no sound
07:36 (29)				Ollie hand returns to cupped fist in front of chin and mouth	Ollie's head moves from right to the left - glancing over shoulder			Ollie headphones on, no sound

Screenshots of Episode Four



07:24 (29) Screenshot of the episode's first frame



07:36(29) Screenshot of the episode's end frame

Both screenshots show bars 1 to 17, indicating the potential area of Alex and Ollie's focus, such as the Dr Who track from the beginning of the composition. No sound was evident. The two screenshots show Safari, the internet browser, had been activated (A). Activating Safari was consistent with the teacher's pedagogical framing in that the pupils were to view the assessment criteria alongside their composition. From the screenshots, the audio track (B) has been opened in the score function (although muted), suggesting the pupils' focus may be on their compositional work. However, the differences between the first and last screenshots show the mouse movement searching for something.

Interpretation of Episode Four

The analysis for this episode was 12 seconds and focused solely on Ollie's engagement as being significant in his design for learning. Between 07:24 and 07:26, Ollie rested his left elbow on the desk, with his thumb under his chin, whilst his hand formed a fist-like shape that he placed in front of his mouth and nose. His gesture, with his gaze fixed on the computer screen, suggested he was either deep in thought or waiting for his partner to return. The following three frames (07:27 to 07:29) showed a brief change in resources where Ollie started to tap on the keyboard. As the mode of sound was absent, this perhaps suggested he was biding his time whilst awaiting Alex's return.

At 07:29, Ollie tilted his head upwards, glanced at the computer screen, moved his hand from the keyboard to the mouse and started to move it around as if searching for something on the software. It appeared that Ollie had evaluated part of the composition and started to adjust their work or that he had internalised an idea and was looking at the software to support him. At 07:30, the analysis evidenced Ollie's mouse movements suggesting that he was implementing that decision. We know this as the direction of his gaze clearly showed his eye movements as upwards, to the left, to a central spot and then to the upper right of the computer screen, which supports the notion of visually searching the software for that significant something.

Although Episode Four appeared mundane, it provided an example of the social norms that occur during setting up routines and the common problems pupils experience with resources. In the framing of the overall lesson, this episode followed from where the pupils were listening to and reviewing their compositional work thus far. An equally probable explanation of this episode could suggest the aim was to attend to the teacher's pedagogical framing: open the school's Moodle platform and use the assessment criteria to review the composition.

This interpretation raises questions about how multimodal theory can ascertain and analyse the assessment parameters. Although Kress and Selander (2012) incorporate teacher assessment practices into their design for learning theory, the thesis primarily focuses on pupils' design for learning. Interestingly, throughout the 12-second episode,

no significant transductions or transformations occurred. This finding advises us that nothing substantial towards the compositional process manifested. Ollie's actions reflected sequential decision-making, consideration of the teacher's pedagogic framing, and awareness of the tasks to complete before the lesson ended. In essence, Ollie enacted his design for learning (whilst he recognised Alex's intentions and signals) and used the 12 seconds to set up a point within the composition in which their attention was needed. The episode showed that Alex and Ollie were finally working in collaboration with each other.

5.5.2 Episode Eleven

Approximately seven minutes elapsed between Episodes Four and Eleven. The pupils continued to work on completing the composition. The work involved listening, reviewing, copying and pasting tracks. This episode analyses the pupils' locating and adding a movie marker.

Mapping of resources available for communication.

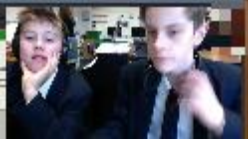
Preceding Modal Prompt [Lesson 4 Episode 11] Alex speech (<i>let's find out when they speak</i>), gaze and mouse pointing Ollie verbal suggestion (<i>look, it's when those two inaudible</i>), gaze and gesture								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
13:23 (10)				Ollie's right arm midway between monitor and desk Ollie's left elbow is on desk with hand clasped against side of face, covering mouth Alex hand over mouse	Both Alex and Ollie gaze at monitor	Alex looks tense	Ollie leans left towards Alex Alex has left elbow on desk with hand hovering over qwerty	Both have headphones on, no sound

13:24			Alex qwerty - play function	Ollie's hand opens and fingers rest on cheek, chin is in palm of hand; head tilted downwards	Alex eyes glance left still focused on monitor Ollie looking at monitor		Ollie moves upper body right sitting up	Both have headphones on Harp - Clara motif (3 falling notes)
13:25				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards Alex moves mouse to a frame on clip	Both Alex and Ollie looking at monitor Alex eyes central to frame		Ollie leans forward closer to the desk	Both have headphones on Harp - Clara motif (held note)

13:26				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Both Alex and Ollie looking at monitor			Both have headphones on Harp - Clara motif (2 falling notes)
13:27				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Both Alex and Ollie looking at monitor			Both have headphones on Harp - Clara motif (falling and step up) Horn - Dr Who (held note)
13:28				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Both Alex and Ollie looking at monitor			Both have headphones on woodwind and brass (held chords)

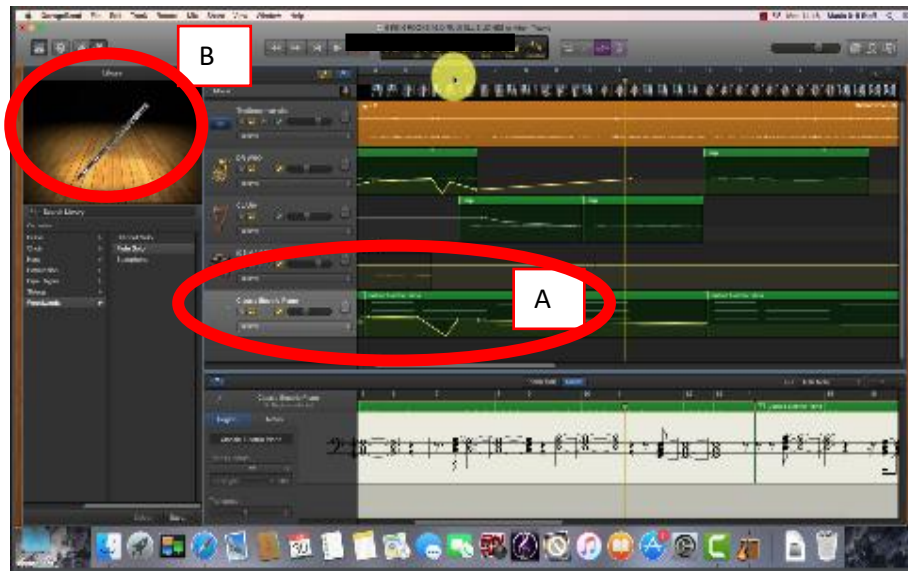
13:29				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Ollie's gaze lowers Alex continues to focus on monitor	Ollie frowns		Both have headphones on woodwind (held chords)
13:30				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Ollie's gaze remains low Alex continues to focus on monitor	Ollie frowns		Both have headphones on woodwind (held chords)
13:31				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Ollie's gaze rises to monitor Alex continues to focus on monitor			Both have headphones on woodwind (held chords)

13:32				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Both Alex and Ollie looking at monitor			Both have headphones on Harp motif repeats Woodwind (repeated chordal pattern)
13:33				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Both Alex and Ollie looking at monitor			Both have headphones on Harp motif continues Woodwind chords Clara (<i>what's</i>)

13:34				Ollie hand open resting over mouth and nose fingers on side of cheek; head tilted downwards	Both Alex and Ollie looking at monitor			Both have headphones on Harp motif continues Woodwind chords Clara (<i>this?</i>)
13:35			Alex qwerty - stop function	Ollie raises head from hand and tilts chin upwards Alex tilts head left	Both looking at monitor			Ollie headphones on Alex removes headphones no sound
13:36			Alex moves mouse	Ollie rests open chin in palm of hand with open fingers on cheek	Both looking at monitor		Alex sits upright	Ollie headphones on, Alex removing headphones no sound

13:37			Alex moves mouse to score function	Ollie rests open chin in palm of hand with open fingers on cheek	Both looking at monitor			Ollie headphones on no sound
13:38			Alex moves mouse to Clara's motif	Ollie rests open chin in palm of hand with open fingers on cheek	Both looking at monitor			Ollie headphones on no sound
13:39			Alex picks up mouse from the desk	Ollie rests open chin in palm of hand with open fingers on cheek	Alex gaze turns right and downwards			Ollie headphones on no sound
13:39 (28)								Ollie headphones on no sound

Screenshots of Episode Eleven



Screenshot of the episode's first frame 13:23 (10)



Screenshot of episode's end frame 13:39(28)

No sound was evident in the two frames, suggesting the pupils focused on the editing tasks. The pupils worked on the middle section of their composition. We know this as the cursor rested on Bar 11 and remained there (see the end frame). The screenshots suggest that Alex and Ollie attended to a small fine-grained part of the composition, which was visible on the computer screen. The pupils might have been attending to the chords, intended as background music to the motifs, which supports the teacher's pedagogical framing. The first screenshot shows a lighter grey for the track that Alex and Ollie focused on (A). Underneath this track, the score function shows chordal notation with the chosen woodwind - bassoon

(B). The pupils' instrumental knowledge is questionable since bassoons cannot play chords. I wonder if this motif was played on the keyboard or entered step-by-step using the score function.

Interpretation of Episode Eleven

The preceding modal prompt notes Ollie's verbal suggestion of, '*Look, it's when those two,*' and his physical gesture of pointing at the computer screen. The start of the episode foregrounded the mode of gaze as both pupils focused on the tracks shown by the software programme. There was some ambiguity in which track Ollie referred to as his arm only extended midway towards the computer screen, although we can assume that he referred to the audio and visual tracks of the characters. This prompt further suggests they were attending to the character's modes of speech to identify a location to add a motif. An equally plausible consideration to support the pupils' meaning-making was foregrounding the character's mode of action.

Alex and Ollie focused on the characters' modes of speech and action, which added another complex layer to the analysis as the pupils needed to determine which point signified the correct positioning for a movie marker. The implication of getting it wrong would suggest the pupils did not understand the significance of the musical feature, nor its function, which would have had consequences in the assessment. Therefore, this episode indicated that their designs for learning focused on adding a movie marker. However, over the duration of this episode, the modes and resources of modes suggested that other communication also occurred, such as boredom and a change in activity.

The opening frame of the episode described Alex's facial expression as tense, and in order to better understand why, other modes need to be foregrounded. Alex positioned himself close to the desk with his left elbow and forearm lying flat. His left hand hovered over the QWERTY keyboard and his right arm stretched across and in front of Ollie to operate the mouse. The modal ensemble signified that Alex was attending to something significant and these actions foregrounded his focus.

Over the following ten frames, from 13:24 to 13:34, Ollie adopts a position closer to the desk to enact his boredom through a gesture. He rested his left elbow on the desk, with his open hand covering his mouth and nose and his fingers on the side of his cheek. Although he gazed in the direction of the computer screen, he alternated his

head between high and low positions, suggesting he had some motivation to participate. The mode of sound was concurrently foregrounded and worked in correlation with the visual of the Dr Who clip (BBC, 2012). These interacting modes allowed Alex to signal with the pointing of the mouse at a particular frame on the software, such as 13:25, where he and Ollie needed to focus their attention.

At 13:35, Alex stopped the playback by pressing the spacebar on the QWERTY keyboard, which prompted Ollie to raise his head from his hand. The next frame (13:36) showed Alex's response, a transformation, as Alex sat upright, removed his headphones and reached across and in front of Ollie, moving the mouse. Ollie recognised that this ensemble of modes signified something new was going to happen. During the four frames (13:36 to 13:39), Ollie kept his left elbow on the desk and continued to rest his chin in the palm of his hand. He also continued to watch the computer screen and followed Alex's mouse movements. Although the ensemble of modes illustrated Ollie's slightly awkward posture and body positioning, together with his sustained gaze at the computer screen, it demonstrated his engagement.

Ollie was engaged with Alex's gesture and pointing of the mouse and what the mouse was attending to. It showed Alex's interest in a specific area of the composition, specifically when Clara, on the clip's audio track, says, '*What's this?*', identifying the possibility of a movie marker. Here, the mouse purposefully opened the score function on the software and then moved towards Clara's motif track. The episode ended here, meaning no further crystallisation of their learning occurred. However, Ollie's preceding modal prompt of speech and gesture, with Alex's transformation of resources at 13:35, illuminated that they had located a movie marker. The pupils orchestrated their modes and resources of modes by attending to the characters' audio cues to pinpoint the exact frame in which to position the movie marker.

5.5.3 Episode Twenty-four

During the 15 minutes between Episode Eleven and this episode, the pupils continued their compositional efforts. Two different moments were removed from the lesson mapping, approximately five minutes in duration (Stage One; Section 4.5.1). The first

moment was due to ethical reasons, and the second was the whole class teacher input that lasted for just under four minutes. Interestingly, Alex and Ollie ignored the teacher's pedagogical framing and continued on their learning path.

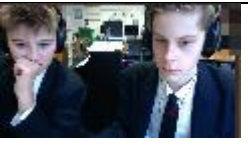
This 38-second episode captured some of the pupils' most endearing moments during the research process. These reveal their personalities, agency and interests.

Mapping of resources available for communication.

Preceding Modal Prompt [Lesson 4 Episode 24] Ollie action keyboard and gaze Alex action headphones, gaze and mouse								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer- generated Sound
27:34 (03)			Ollie plays tune on keyboard		Both look at monitor		Alex and Ollie sit parallel; Ollie sat upright and Alex head tilted back slightly	Ollie headphones on low pitch male choir sound
27:35			Ollie continues playing keyboard Alex pulls up headphones		Ollie gazes downward s towards keyboard Alex gazes right		Alex rounds shoulders to put headphones on	Ollie headphones on, low pitch male choir sound

27:36			Ollie playing keyboard at both ends Alex positions headphones over ears		Alex looks at monitor Ollie glances left and downwards towards hand at bottom end of keyboard	Alex frowns	Ollie leans forwards and extends left arm in front of Alex Alex rounds shoulders to put headphones on	Ollie headphones on sound stops
27:37			Ollie continues playing keyboard at both ends Alex action qwerty		Ollie gazes at monitor		Ollie leans forwards and extends left arm in front of Alex Alex straightens body up	Alex and Ollie headphones on,
27:38				Alex right hand over mouse and left hand above qwerty	Both gaze at monitor		Ollie sits back in chair moving left arm out of Alex's way Ollie position with elbow closer to the desk than Alex	Alex and Ollie headphones on, Clara intake of breath Ice Governess (grrr)

27:39				Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand above qwerty	Both gaze at monitor		Ollie rests left elbow on desk	Alex and Ollie headphones on, sound effect - key dropping on floor
27:40				Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand above qwerty				Alex and Ollie headphones on, sound effect - key bouncing on floor low pitch male choir voices - melody rising by step

27:41				Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand above qwerty				Alex and Ollie headphones on Clara (<i>agh</i>) Ice Governess (<i>grrr</i>) low pitch male choir voices - melody falling by step
27:42			Ollie plays high pitched note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand above qwerty				Alex and Ollie headphones on Dr (<i>Clara</i>) held vocal chord

27:43				Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand above qwerty				Alex and Ollie headphones on Dr (<i>Clara</i>) Clara (<i>get off of me</i>)
27:44				Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand above qwerty				Alex and Ollie headphones on male choir voices lower in pitch and sustained

27:45				Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand over mouse and left hand resting on qwerty				Alex and Ollie headphones on Dr (inaudible) male choir voices lower in pitch and sustained
27:46			Ollie plays a different high pitched note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex rests left (cupped) hand over mouth and chin			Alex leans to his left resting his elbow on the desk	Alex and Ollie headphones on Dr (<i>should have realised</i>) pitch rises and falls a tone then note sustained Clara (get off)

27:47			Ollie continues to play high pitched note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex rests left (cupped) hand over mouth and chin			Alex continues leans to his left resting his elbow on the desk	Alex and Ollie headphones on <i>Dr (let her go)</i> held chords clashing with Ice Governess motif
27:48			Ollie continues to play high pitched note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex rests left (cupped) hand over mouth and chin			Alex continues leans to his left resting his elbow on the desk	Alex and Ollie headphones on repetition of Ice Governess motif - melody rising

27:49			Ollie continues to play high pitched note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex rests left (cupped) hand over mouth and chin			Alex continues leans to his left resting his elbow on the desk	Both have headphones on repetition of Ice Governess motif - melody rising then falling held high pitched note Dr (<i>Clara</i>) Clara (<i>get off of me</i>)
27:50			Ollie adds another high pitched note on keyboard	Ollie rests chin on thumb with fist to side of mouth and nose Alex rests left (cupped) hand over mouth and chin	Ollie's eyes wide open; looks left towards partner Alex's eyes glance right towards Ollie		Alex continues leans to his left resting his elbow on the desk	Alex and Ollie headphones on clashing of sustained notes Dr (<i>no</i>)

27:51				Ollie rests chin on thumb with fist to side of mouth and nose Alex rests left (cupped) hand over mouth and chin	Ollie still looking at Alex Alex refocuses on monitor	Both pupils are grinning	Alex continues leans to his left resting his elbow on the desk	Alex and Ollie headphones on Clara intake of breath

27:52				Ollie rests chin on thumb with fist in front of mouth and nose Alex rests left (cupped) hand over mouth and chin moves slightly away from mouth		Both pupils continue to grin	Alex continues leans to his left resting his elbow on the desk	Alex and Ollie headphones on Dr (<i>Clara</i>)

27:53				Ollie rests chin on thumb with fist in front of mouth and nose Alex rests left (cupped) hand over mouth and chin moved slightly away from mouth	Both looking at monitor	Both pupils continue to grin	Alex continues leans to his left resting his elbow on the desk	Alex and Ollie headphones on <i>Ice Governess (arghh)</i>
27:54			Ollie playing high pitched note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand on mouse	Both looking at monitor	Ollie still grins Alex relaxes face to a grin	Alex lowers elbow and arm shifting body position upwards	Alex and Ollie headphones on high pitched 'ah' sound repeated quickly

27:55			Ollie continues to play high pitched repeated note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose	Both looking at monitor	Ollie still grinning		Alex and Ollie headphones on Ice Governess (<i>arghh</i>) high pitched 'ah' sound repeated quickly
27:56			Ollie continues to play high pitched repeated note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand on mouse; left hand hovers over qwerty	Both looking at monitor	Ollie still grinning		Alex and Ollie headphones on Ice Governess (<i>arghh</i>) high pitched 'ah' choir sound repeated quickly

27:57			Ollie continues to play high pitched repeated note on keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand on mouse; left hand hovers over qwerty	Both looking at monitor	Alex looks annoyed - strained facial muscles		Alex and Ollie headphones on Ice Governess faint sounding (<i>argh</i>) high pitched 'ah' choir sound repeated quickly
27:58			Alex removes Ollie's hand from the keyboard	Ollie rests chin on thumb with fist in front of mouth and nose Alex right hand pushes Ollie's hand away from keyboard left hand hovers over qwerty	Alex glances at Ollie's hand on the keyboard Ollie focused on monitor			Alex and Ollie headphones on

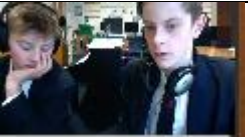
27:59			Alex plays high pitched note on keyboard	Ollie rests chin on thumb with fist to left side of face Alex left hand hovers over qwerty	Ollie gazes downwards and right at hands on keyboard		Ollie's left shoulder moves further forward on desk	Alex and Ollie headphones on sound effect - Dr's sonic screwdriver Dr (<i>Clar</i>) high pitched 'ah' choir sound
28:00			Alex sustains high pitched note on keyboard	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex focuses on monitor		Ollie's leans further to his left positioning himself closer to the desk and keyboard	Alex and Ollie headphones on Dr (<i>rar</i>) high pitched 'ah' choir sound
28:01			Alex sustains high pitched note on keyboard	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex focuses on monitor			Alex and Ollie headphones on Dr (<i>rar</i>) high pitched 'ah' choir sound

28:02				Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex focuses on monitor			Both have headphones on Dr (<i>rar</i>) Ice Governess faint sounding (<i>argh</i>)
28:03			Alex plays the same high pitched note on keyboard	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex focuses on monitor			Alex and Ollie headphones on Ice Governess faint sounding (<i>argh</i>) Choir high pitched sustained 'ah'
28:04			Alex sustains high pitched note on keyboard	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex focuses on monitor			Alex and Ollie headphones on Choir high pitched sustained 'ah'

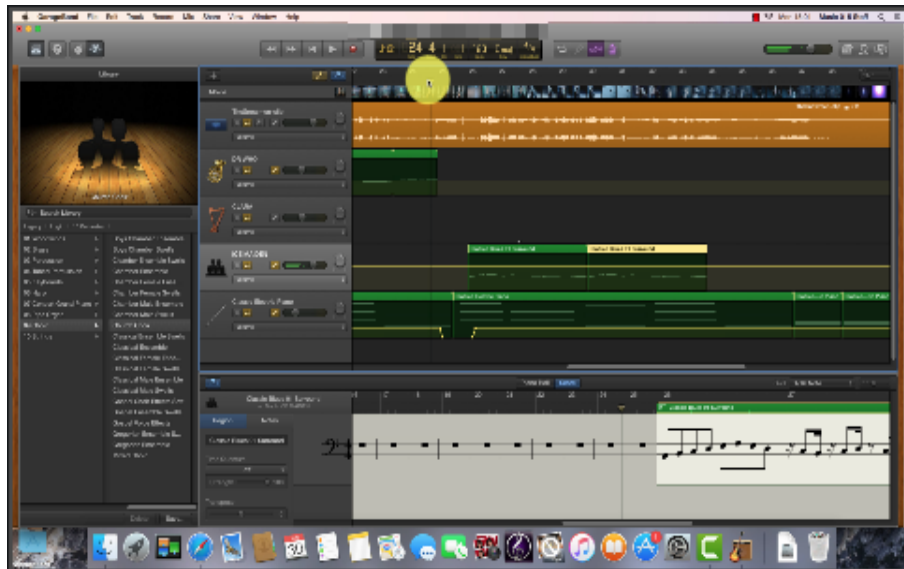
28:05			Ollie goes to play keyboard Alex plays keyboard	Ollie rests chin on thumb with fist to left side of face	Ollie gazing downwards Alex focuses on monitor			Both have headphones on
28:06			Ollie continues to touch keyboard keys	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex glances left on monitor			Alex and Ollie headphones on no sound

28:07			Ollie continues to touch keyboard keys	Ollie rests chin on thumb with fist to left side of face Alex right hand on mouse; left hand hovers over qwerty	Ollie continues gazing downwards Alex focuses on monitor		Alex sits back and straightens his posture	Alex and Ollie headphones on no sound
28:08			Ollie continues to touch keyboard keys	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards Alex focuses on monitor			Alex and Ollie headphones on no sound
28:09			Ollie continues to touch keyboard keys	Ollie rests chin on thumb with fist to left side of face	Ollie continues gazing downwards		Alex leans forward	Alex and Ollie headphones on Dr (rar)

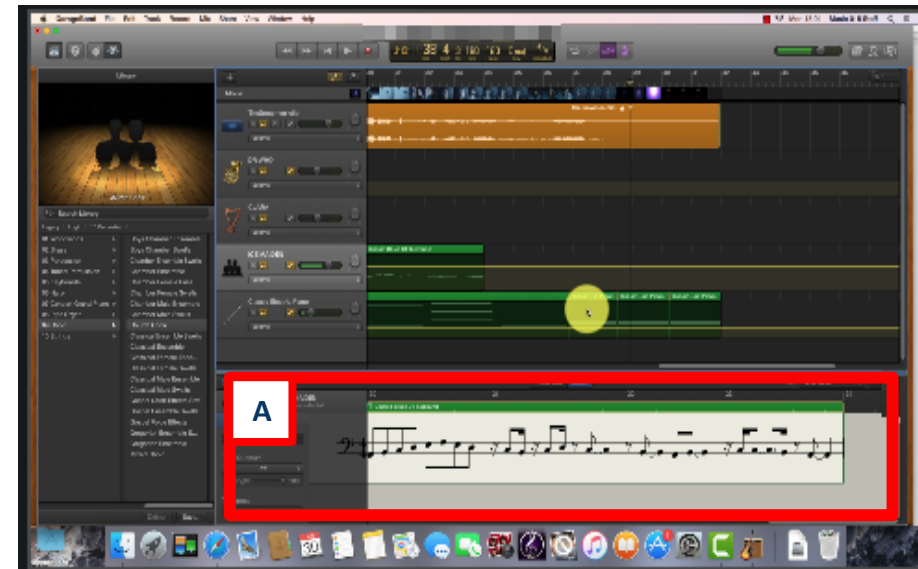
					Alex focuses on monitor			
28:10			Ollie continues to touch keyboard keys	Ollie opens left hand out and places over his mouth as he tilts his head right	Ollie gazes right at monitor			Alex and Ollie headphones on Dr (<i>rar</i>) Ice Governess faint sounding (<i>argh</i>)
28:11			Ollie continues to touch keyboard keys	Ollie moves left hand to his chin head still tilted right	Both looking at monitor			Alex and Ollie headphones on Dr (<i>rar</i>) Ice Governess faint sounding (<i>argh</i>)
28:12			Ollie continues to touch keyboard keys	Ollie moves left hand to his chin head still tilted right	Both looking at monitor			Alex and Ollie headphones on no sound

28:13			Ollie places hand over keys on keyboard	Ollie moves left hand to his chin head still tilted right	Both looking at monitor			Alex and Ollie headphones on no sound
28:14			Ollie plays the keyboard Alex removes headphones	Ollie moves open left hand to left side of face; head straightening	Both looking at monitor		Ollie sit upright moving shoulders to the left	Ollie headphone on high pitched choir 'ah' sound
28:15			Ollie continues to play the keyboard	Ollie moves open left hand to left side of face; head resting on palm	Both looking at monitor			Ollie headphone on high pitched choir 'ah' sound
28:15 (15)				Ollie moves open left hand to left side of face;	Alex looking at monitor			

Screenshots of Episode Twenty-four



27:34 (03) Screenshot of the episode's first frame



28:15 (15) Screenshot of the episode's end frame

In the first frame, the mouse (indicated by the yellow circle) points towards Bar 24 of the Doctor. The episode's last screenshot shows the mouse has moved and hovered over the background music track (Bar 33). The score function (A), located at the bottom of the interface, shows the notation from the Ice Governess motif. Several plausible interpretations arise suggesting that the pupils could have attended to the quantisation of the motif, added a movie marker, added dynamics or changed the motif's melody. Whichever of these occurred cannot be determined from the screenshot, but it does suggest that the pupils' design for learning involved editing their composition.

Interpretation of Episode Twenty-four

The first three frames of this episode (27:34 to 27:36) opened with Alex signalling to Ollie (by pulling up his headphones from his shoulders) that he had an idea. In the interim, Ollie continued to play the keyboard at both the higher and lower pitched ranges which appeared to suggest that he was mucking around. At 27:36 Alex frowned, communicating either his disapproval of Ollie playing the keyboard in such a manner or that he was stressed and wanted to get on with the composition. The interaction between Alex and Ollie showed a disconnection in engagement. Although Ollie's posture was upright and actively playing the keyboard, his gaze was unsettled, moving between the computer screen, keyboard and Alex's hand gestures. This directional gaze became resolved at 27:38 when Alex took control of the mouse in his right hand with his left hand hovering over the QWERTY keyboard. The mapping of resources showed Ollie being compliant with Alex's signal as he moved his arm out of the way and sat back in his seat as if accepting Alex's control.

Ollie changed his body positioning, posture, gesture and gaze, and re-engaged in the composition (27:39). Figure 5.10 illustrates Ollie's left elbow on the desk, with his left hand forming a fist-shape that rested in front of his mouth and nose. The significance of this transformation not only showed his attention but also foregrounded that the mode of sound and the visualisation of the Dr Who characters were instrumental in the learning that followed.



Figure 5.10: Screenshot taken from Lesson Four at 27:39 - the pupils' signs of engagement

Ollie's gaze continued to move from left to right across the computer screen and towards his partner's hands, signifying his continued engagement (27:39 to 27:45). The transcript showed Alex and Ollie simultaneously enacted their own small transformations, shown through their body positions and continued gaze (27:46), in which they seemed to recognise and accept each other's intentions. Ollie appeared to be randomly playing the keyboard, although he did choose notes that melodically and rhythmically fitted with the composition's playback. At this stage, it was unknown whether Ollie was trying to enhance the composition's background melody or whether his contribution was for a particular motif. Alex, however, changed his body position, placed his left elbow on the desk and cupped his left hand over his mouth and chin. With the continued modes of sound and gaze, it was evident that Alex was evaluating the aural and/or the visual components of the Dr Who clip (BBC, 2012) to support the development of a movie marker. I state 'and/or' for two reasons. First, the mapping of resources does not display the computer screen. However, a reasonable interpretation of the transcript indicates that the modes of sound and gaze were foregrounded. Second, the teacher's pedagogical framing and input on movie markers implied that the pupils would use the characters' modes of speech with their corresponding visual actions.

In later frames (27:50 to 27:53), the purpose of the continued repetition of notes Ollie had played became clearer as both pupils turned and looked at each other. A transformation of resources showed Ollie's facial expression and gaze changed from innocent-looking to wide-eyed and smiling as he directed his communication towards Alex. This semiotic action was reciprocated with a grin from Alex, showing their personalities, agency and the fact that Ollie was playing around rather than contributing to the composition.

From 27:54, Alex lowered his left arm, moved his hand away from his face and shifted his body position upward as if moving on to the next part of the task. However, Ollie remained mischievous and continued to play a repetitive high-pitched note on the keyboard. Alex responded to this signal (of boredom) by focusing his attention on the computer screen, his facial expression becoming one of concentration and his hand gestures actively resuming moving the mouse with his right hand and with his left hand

hovering over the QWERTY keyboard (27:56). Alex's facial expression again notably changed at 27:57 where I interpreted that he was becoming annoyed with Ollie's persistent playing of the same high-pitched note on the keyboard. We know this because Alex showed signs of a strained jaw while the frame synchronously showed Alex removing Ollie's hand from the keyboard (28:58). Although it seemed that Alex tried to ignore Ollie and continue with the composition, Ollie had other intentions. Even though humour, resilience, and now annoyance could be interpreted, Alex refocused and attended to the playback.

5.5.4 Episode Forty-two

Eighteen minutes passed between Episodes Twenty-four and Forty-two, during which the pupils reviewed and edited the composition, and Alex played 'Someone Like You' by Adele.

The teacher approached the pupils and asked to listen to their compositional work. This episode shows how Alex and Ollie responded to the teacher listening to their composition. The preceding modal prompt showed how Alex and Ollie repositioned themselves to accommodate the teacher's standing position in between and slightly behind them.

It is worth noting that permissions were received (from the teacher) for inclusion in the analysis and findings of Episode Forty-two.

Mapping of resources available for communication.

Preceding Modal Prompt [Lesson 4 Episode 42] Ollie talking to Alex (<i>inaudible</i>) then both laugh [continuation from Ep40] Alex and Ollie positioning; gaze and sound								
Time	Integrated Webcam	Side Camera	Action	Pointing/ gesture	Gaze	Facial expression	Body Movement and/or position	Computer-generated Sound
46:29 (10)				Alex hand on chin Ollie right hand over right side of face Teacher arms folded	Ollie's eyes squinted Alex's eyes are closed Both gaze forward at the monitor	Ollie mouth open, laughing inwardly Alex mouth open	Teacher stands at a 45 degree angle to desk and pupils with wall behind Ollie leans right elbow on desk Alex leans left elbow on desk	Clara (<i>get off of me</i>) choir low pitched male voices

46:30					Alex slight gaze left as head tilts	Ollie mouth closing		Dr (<i>no</i>) Clara (inhale of breath) choir low pitched male voices
46:31				Alex left hand moves downwards on chin	Alex gaze returns to monitor; chin high	Ollie mouth closed	Alex moves head upwards	Dr (<i>Clara</i>) choir low pitched male voices
46:32					Alex lowers head and gaze to monitor Ollie lowers head settles in right hand	Alex and Ollie smiling		Ice Governess (<i>arghh</i>) choir low pitched male voices

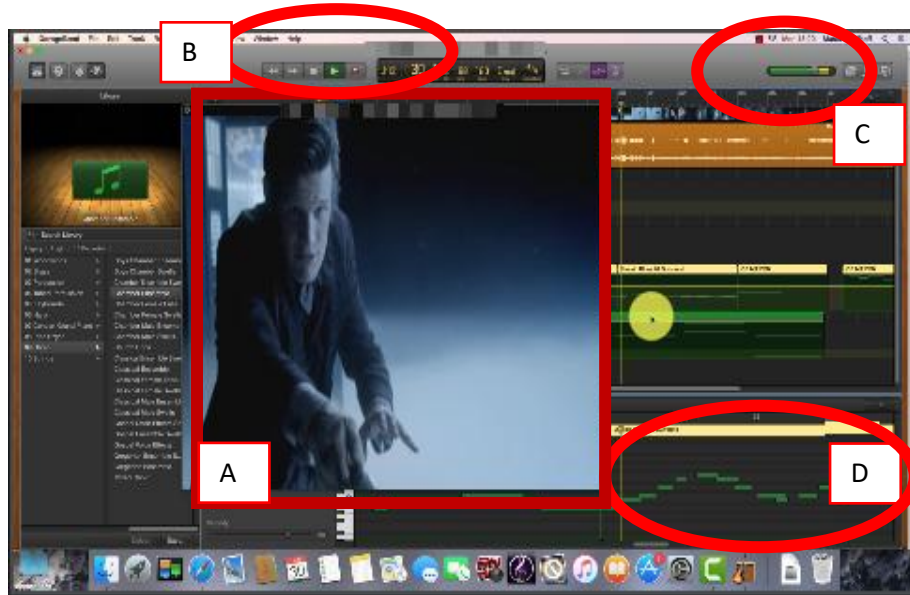
46:33					Alex lowers chin further			choir low pitched male voices
46:34						Alex and Ollie's expression appear more relaxed and focused		Ice Governess (<i>ah . . arghh</i>) choir low pitched male voices
46:35				Alex left open hand covers mouth	Alex tilts head to the left		Alex moves further onto his left elbow	Ice Governess (<i>arghh</i>) choir low pitched male voices
46:36								Ice Governess (<i>arghh</i>) choir low pitched male voices

46:37				Alex hand drops slightly from mouth		Ollie grins		medium pitched sustained 'ah' sound
46:38				Ollie right hand becomes fist covering left eye and mouth	Ollie's gaze becomes partially obscured		Ollie's head position moves downwards into hand	medium pitched sustained 'ah' sound
46:39				Ollie right hand becomes fist covering left eye and mouth		Ollie covers grin		medium pitched sustained 'ah' sound
46:40				Ollie's fist moves to cover mouth	Ollie's eyes closed		Ollie sits up straight	Dr (Clara) sound effect of sonic screwdriver

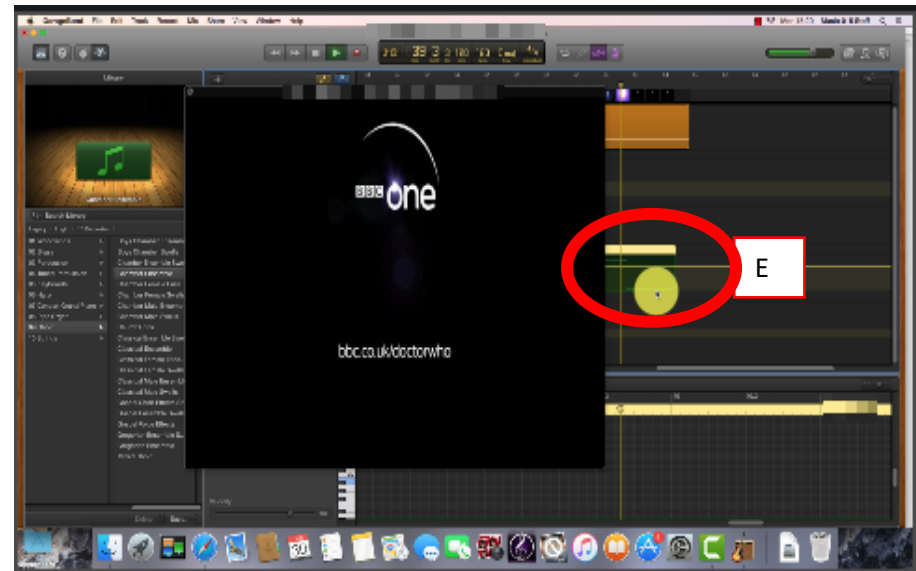
46:41				Ollie's right hand covers mouth					Dr (<i>Clara</i>)
46:42						Ollie controls grin			Dr (<i>Clara</i>)
46:43									Dr (<i>Clara</i>) Ice Governess (<i>argh</i>) high pitched choir ensemble melody: <i>[pop]</i>
46:44						Ollie grins			high pitched choir ensemble melody: <i>[goes the]</i>

46:45						Ollie grin becomes more visible Alex smiles		high pitched choir ensemble melody: <i>[weas]</i>
46:46								high pitched choir ensemble melody: <i>[sel]</i>
46:47				Ollie removes hand from mouth and places on desk	Ollie turns head and gaze left towards Alex	Ollie and Alex laugh	Ollie turns shoulders and body left towards Alex	high pitched choir ensemble melody: <i>[sel]</i>
46:48					Ollie lowers head and gaze	Ollie continues laughing		Teacher sniggers

Screenshots of Episode Forty-two



46:29 (10) Screenshot of the episode's first frame



46:48 (06) Screenshot of the episode's end frame

The computer screen shows many musical elements coming together to form the pupils' composition. I have highlighted five areas that might contribute to understanding what occurred. These five areas (A to E) are addressed sequentially. The first screenshot shows an enlarged frame of the Doctor reaching his arms out in front of him (A). It suggests that the episode's primary focus is the visual representation of the Dr Who clip (BBC, 2012) whilst the composition plays in the background (B and D). The dynamics (C) tipped from green into yellow, perhaps indicating the representation of a movie marker and that the score function was open (D). However, the overall focus in the first screenshot appears to indicate a review of the music

with the visual representation. The second screenshot shows the end of the Dr Who clip (BBC, 2012) with a bar or so left to play (E). It is conceivable that Alex and Ollie were refining or reviewing the end of their composition. It is also reasonable to assume they were reviewing the whole composition, although neither screenshot confirms this.

Interpretation of Episode Forty-two

The first frame (46:10) communicates several interactions that simultaneously occurred. First, and perhaps most notably, are the pupils' facial expressions of laughter and smiling. Although this interaction was silent, their hands partially covered their mouths, signalling their momentary embarrassment of something within their composition. The interpretation could also suggest an unsettling disposition they felt as the teacher stood cross-armed behind them. However, both pupils positioned themselves at an angle, inviting the teacher to view the computer screen. Alex leant his left elbow on the desk where his body positioning was almost out of the transcript frame due to leaning so far to the left, whereas the opposite was true for Ollie, leaning on his right elbow positioned as far right as the desk would allow. The teacher was visibly positioned with crossed arms, partly listening to the composition and partly monitoring the rest of the classroom. We know this as the teacher's body position is angled at 45° rather than forward-facing.

At 46:31, Alex communicated his interest, or sense of pride, in what was heard in the composition. We know this as he conjointly moved his hand downwards on his chin and tilted his head upwards. The interaction lasted for two frames, where on the third frame, Alex lowered his head before he transitioned into another position at 46:35. Meanwhile, Ollie had refocused his attention on the computer screen and appeared more comfortable with the teacher's presence and the compositional content.

Alex's body posture, as well as his open hand covering his mouth, showed his left elbow leaning on the desk, which signalled contemplation as the modes of gaze and sound became foregrounded (46:35). Alex maintained this position for a further ten seconds before he disappeared off to the left of the frame. During these particular frames (46:37 – 46:45), Ollie's hand gesture changed from a relaxed hand on his cheek to a fist-shaped hand covering his mouth. This action coincided with the on-screen visual of the Ice Governess struggling and then falling, which was accompanied by the mode of sound. This sound was represented by a chorus of male voices in a medium-pitched and sustained 'ah' sound. It signalled one of two possible meanings. First, Ollie indicated

anticipation of what was to come in the composition. An alternate interpretation would suggest he was either embarrassed or pleased with the 'ah' sound, as this was his contribution to the composition.

The final four frames of this episode (46:45 to 46:48) signalled the end of the composition playback as the tune of 'Pop Goes the Weasel' was audible. This prompted both Ollie and Alex to respond by smiling as they turned to face each other and laughed. Ollie lowered his head further and turned his body towards Alex, perhaps communicating anticipation of potential negative comments to come from the teacher.

Whilst this particular episode showed little in the way of the pupils' design for learning, it does show the materialisation of their compositional ideas and how we can hypothetically recover meanings (Bezemer and Jewitt, 2010; Kress, 2010). The episode further made visible the pupils' insecurities about their composition and the emotional reactions that surrounded this. With the teacher's added presence, it could be perceived that they were anxious to do well and to please the teacher. However, notably, the pupils knew that there were some questionable aspects of their composition, such as the inclusion of 'Pop Goes the Weasel', which did not escape the teacher's scrutiny.

The episode emphasised one of the final compositional processes, before assessment, aimed at supporting the pupils' development in reviewing and refining any questionable aspects. The episode indirectly related to the teacher's pedagogical framing as outlined at the beginning of Lesson Four, where pupils were instructed to use the assessment criteria to review their composition.

5.5.5 Summary of Lesson Four

The duration of this fourth lesson was just over one hour long. In total, there were 51 instances of non-verbal communication, including four teacher inputs. From the data set three episodes were removed due to ethical considerations, i.e. group work involving non-participant pupils. A total of 1 minute and 25 seconds was analysed.

The teacher's pedagogical framing indicated a slight change from the initial plan, bringing together all of the pupils' compositional elements: three leitmotifs, background music, movie markers and quantisation, combining these with the assessment criteria to enable the pupils to self-evaluate their composition. Of the four episodes, Episode Four showed the pupils' recognition that they had a lot of work to complete during the lesson and not much time to do so. For example, the orchestration of modes showed the activities of searching for specific compositional areas to complete and reviewing their work. As such, Alex and Ollie's collaboration, or co-design, for their learning materialised (Kress and Selander, 2012). The remaining three episodes showed the pupils' continued collaboration as they reviewed, edited and refined the composition and evaluated the compositional product in the teacher's presence.

5.6 Chapter Summary

Chapter Five has provided a qualitative and in-depth micro-analysis of sixteen instances of non-verbal ('silent') communication together with screenshots of the episodes' first and last frames. Each episode presented interpretations from the screenshots and instances of non-verbal communication as Alex and Ollie engaged in a Dr Who (BBC, 2012) leitmotif computer-based compositional task. This section summarises the chapter and my study's key findings.

Over four music lessons, I operationalised the theory of multimodal social semiotics to first generate a data set. In creating the overall lesson transcript, I mapped all occurrences of the pupils' semiotic work that met the criteria for being an instance of non-verbal communication. This meant that each episode was absent from the mode of speech and lasted more than ten seconds.

The second stage involved a transposition of theory to examine what materialised and this process applied the principles of recontextualization (Bezemer and Kress, 2016). Each instance of non-verbal communication analysed used a representative selection of preceding modal prompts. The selection criteria included:

- four different preceding modal prompts from each lesson where one always included speech;
- prompts that often contained more than one mode; and
- the prompts always represented two to three seconds prior to the pupils' instances of non-verbal communication.

Each of the four lessons presented:

- a contextual overview of the lesson including the teachers' pedagogical framing;
- four distinct sections where each section represented a different instance of non-verbal communication (named as an episode);
- each episode detailed its positioning within the framing of the whole lesson together with mapping of resources available to the pupils and screenshots of the episode's first and last frames;
- interpretations of the mapping and screenshots; and
- a lesson summary.

The analysis and interpretations presented in Chapter Five address this study's main research question and its three sub-questions:

What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?

- a) What is 'silence' significant of?
- b) What kind of semiotic work happens during instances of non-verbal communication?
- c) How do the modes involved in this non-verbal communication evidence learning?

My study found that when a multimodal perspective is taken on 'silence' (that is, the absence of the mode of speech), it is significant of communicating meaning. The pupils'

instances of non-verbal communication contribute to their designs for learning and, later in their compositional work, becoming co-designers for their learning. The availability of resources for communication regularly transformed to show different signs of learning that often evidenced the pupils' musical learning. Every episode demonstrated the pupils' semiotic work, with clear signs of communication being interpreted. For example, Alex putting on or removing his headphones signified that he had an idea or had just enacted one, as seen in Lesson One Episode Eleven. Other signs of learning that became visible showed features of multimodal social semiotics, such as the pupils' engagement, interest, negotiation, control, approval and disapproval, or the pupils' compositional decisions, such as the trial-and-error method used for selecting instruments.

The analysis demonstrated that further kinds of semiotic work occurred during the instances of non-verbal communication, such as the transformation of resources and transductions. These were found through the pupils' semiotic actions during their non-verbal communication. I identified which orchestration of modes was the most salient within the pupils' semiotic actions to enable interpretation. There was no evidence of whether transductions or transformation of resources had more influence on the pupils' designs for learning, although transductions were less helpful in identifying their musical learning. For example, Lesson One Episode Two evidenced a transduction where the pupils moved between their notation worksheet (writing) and the MIDI keyboard (action – playing). As shown in the analysis, this specific transduction questioned the exact nature of musical learning despite clearly delineating the pupils' designs for learning.

More generally, learning did not always materialise in the selected instances of non-verbal communication, and sometimes it was only a partial recognition. A related example that explains this point was seen in Lesson Two Episode Nine, when Ollie decided which instrument to use, stopped moving the mouse and sat back to watch his partner. Even though learning materialised after Ollie stopped, and at the end of the instance of non-verbal communication, he created new signs of learning through his continued engagement, albeit watching his partner. Another example in which learning materialised as the episode ended was seen after Lesson Three Episode Five, as Ollie

tried to replicate something Alex had played on the keyboard. These occurrences show an unexpected significance of the pupils' instances of non-verbal communication in which Ollie's musical development was initiated as a result of the silence.

The analysis examined six modes: action, gesture, gaze, facial expression, body movement or positioning and sound generated from the computer and these evidenced learning through the transformation of resources. Table 5.2 summarises the modes and the resources of modes, which were available for non-verbal communication and subsequently used for analysis. Alex and Ollie produced numerous configurations of modes in which they aptly chose resources. Each is representative of its potential meaning. An illustration of this could be the different interpretations of Alex's hand gestures, for example showing contemplation. In each instance of non-verbal communication, the different orchestrations of modes reflected the pupils' differing meanings and compositional intentions, which were sometimes ignored or misinterpreted by the pupils, such as Alex physically removing Ollie's hand from the keyboard.

Table 5.2: The pupils' modes and the resources of modes available for non-verbal communication

Mode	Resources of mode
Action	Finding and/or retrieving objects (e.g. pens or headphones) Playing the MIDI keyboard – one finger (melody) or three fingers (chords) Hand position or fingers on (or over) keyboard keys but not pressing Notating on the worksheet Using mouse and/or QWERTY keyboard with hands (e.g. tapping, selecting, clicking) Moving objects to use, (i.e. picking up worksheet or moving the mouse)
Pointing with mouse or gesture	What was the mouse pointing at on the computer screen, when in use? – no particular way of knowing without Camtasia (i.e. transcript does not show this information) Alex's hand gestures – seven different positions Hand position – pointing at the computer screen or elsewhere

Gaze	Direction of gaze, (i.e. left, right, up, down and behind) [lifts/lowers his gaze] at peers, teacher, board, worksheet or around the room Direction of the eyes - object focused on and intensity of the focus Duration of gaze and/or focus Gaze; looking; continues to watch or look; glances at
Facial expression	Smile, grin, mouth slightly open, mouth closing, beginning to laugh, frown, thinking
Body movement and/or position	Proxemics Seating position in relation to partner, (i.e. moves forward, close to desk, sitting back, close to the keyboard, at an angle, next to partner, slumped, leaning). Head and body position (i.e. upright or head tilted)
Computer-generated Sound	Which pupil had headphones on and/or off? Sound being produced including instrument and pitch (where relevant) Melody, chords or something else (i.e. increase in dynamics) Audio track from Dr Who clip (BBC, 2012) Muted tracks

What follows in Chapter Six is a more in depth discussion of these findings.

6.0 Chapter Six: Discussion

6.1 Introduction

Chapter Six presents the main research findings from the analysis, explaining how I have addressed the research questions and discusses these findings in light of the literature. I elaborate on the significance of two pupils' non-verbal communication during their computer-based music composition. Drawing on the in-depth data analysis of 16 instances of non-verbal communication provided in Chapter 5, I explain how this non-verbal communication, initiated by the pupils, constitutes a design for learning. Addressing the key research question *'What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?'* I argue that 'silence' indicates signs of learning, in which the significance of non-verbal communication in the context of computer-based music composition offers new insights, providing a deeper and distinct understanding that differentiates my work, builds on previous research and offers a multimodal social semiotic perspective.

In operationalising multimodal social semiotic theory, my study recognises the interwoven designs for learning of two pupils through their instances of non-verbal communication. In these non-verbal moments, a variety of modes and resources of modes contribute to the pupils' computer-based music composition in a secondary school music classroom setting. The literature review established that non-verbal communication was under-researched in the fields of multimodality and music education. As a former music teacher, I see the need for this research, as teachers have difficulty accessing and interpreting the apparent 'silences' when pupils use computer-based technology to compose. Through an in-depth analysis of two pupils' semiotic actions, focusing on their non-verbal communication, this study has made the pupils' ongoing semiotic work during these 'silences' visible. This research contributes to the field by providing a nuanced understanding of how non-verbal communication facilitates learning in computer-based music composition at Key Stage 3. Silence is complex. It is not banal, generic or arbitrary, as different multimodal configurations have been mapped to show the pupils' meaning-making processes. In multimodal social semiotics, learning is viewed as communication (Kress and Selander, 2012; Bezemer and

Kress, 2016). Therefore, these framed instances of non-verbal communication are moments of action (rather than inaction) and evidence many signs of learning.

This study has two key findings:

- non-verbal modes are significant in the pupils' semiotic actions during computer-based music composition as a detailed multimodal analysis has established that 'silence' is complex and encompasses a diverse array of context-specific meanings; and
- different orchestrations of modes demonstrate the different possibilities through which the pupils' design for learning creates meaningful learning experiences during their computer-based compositional work.

Section 6.2 addresses the first two sub questions:

- a) What is 'silence' significant of? and
- b) What kind of semiotic work happens during instances of non-verbal communication?

It will do this by emphasising the complexities and richness that the multimodality of 'silence' makes visible through the social semiotic concept of sign-making. Through examples, I will highlight the pupils' resourcefulness in selecting apt modes, and the resources of modes which reveal diverse signs of *engagement and interest, control and agency and negotiation*.

Section 6.3 addresses the third sub question:

- c) How do the modes involved in this non-verbal communication evidence learning?

The third sub-question considers the outcome of the pupils' sign-making processes by paying close attention to their *transformation of resources*. Here I will discuss how the

pupils' designs for learning shaped and supported the development of their computer-based music composition. The chapter summary (Section 6.4) summarises the key discussion points.

6.2 The Significance of Non-Verbal Modes in Computer-Based Music Composition

Through the computer-based compositional activities, Alex and Ollie initiated and interpreted meaningful signs of learning driven by their agency and interests (Kress, 2010) but occasionally evidenced instances of simultaneously enacted signs (i.e. Lesson One Episode Two or Lesson Three Episode Ten). The finding broadly supports the work of other studies in the field of music education aligning the pupils' signs of learning with similar themes or compositional categories, for example: engagement (i.e. Kirkman, 2011), collaboration and motivation (i.e. Dillon, 2003; Gall and Breeze, 2005, 2008; Haviland, 2011). Building on multimodal social semiotic theory (Kress, 2010; Bezemer and Kress, 2016), this study found that these signs, such as muting tracks to direct compositional focus (Lesson Three Episode Twenty-five), materialised as tangible actions and decisions. These ideas were often in response to prompts which supported the pupils' interests during context-specific moments of non-verbal communication.

For instance, a common sign showed Alex would put on headphones after periods of internalisation of thought, as shown in Lesson Two Episode Six or Lesson Three Episode Five, which suggested something musical was imminent. This specific mode of action was self-initiated and often preceded by a combination of Alex's modes, such as gaze, gesture and body movement documented in Lesson Two Episode Six, rather than being prompted by Ollie to start a compositional idea. There are close similarities to Fautley's (2005) pre-generative stage (where pupils internalise and manifest their musical ideas through performance), however, this study extends this notion and focuses on non-verbal communication in the computer-based compositional work of two pupils. In this study's context, the approach has shown how non-verbal modes of communication indicate pupils' interest, agency and engagement in music activities.

Therefore, in directly addressing the research question, 'What is silence significant of?', it is important to note that silence is significant of communication and conveys a range of meanings. This study has provided a nuanced and context-specific understanding of how pupils' signs of learning are signified by their complex interactions during non-verbal communication. These instances of non-verbal communication provide opportunities to understand how pupils choose to engage with or ignore signs, which, in turn, reflect and shape their signs of learning and engagement in compositional activities. This understanding is crucial for interpreting the pupils' musical experiences and how, as music teachers, we may best support our pupils.

6.2.1 Signs of Engagement and Interest

Contrary to earlier studies that viewed silence in music composition as inactivity (Kratus, 1989; Seddon, 2001), my research presents a different perspective. The multimodal social semiotic analysis of data has led to the claim that pupils' non-verbal communication makes visible signs of their engagement based on their interests. This sub-section discusses how non-verbal communication in computer-based music composition reveals the diverse ways pupils orchestrate modes and resources of modes that serve as significant indicators of their engagement and interests. Therefore, silence within instances of non-verbal communication should not be interpreted as a lack of compositional activity but as a part of a broader range of communication and learning.

In this series of four lessons, computer-based music composition was indicative of a complex multimodal integration of modes and resources of modes, requiring an understanding of at least four different texts. The pupils engaged with the music technology equipment, worksheets, resources of mode (e.g. direction of gaze), media resources of the Dr Who clip (BBC, 2012) and computer software (GarageBand).

The analysis of sixteen instances of non-verbal communication indicated that the pupils' choices on whether they chose to engage with and/or ignore each other's signs influenced their contributions to the computer-based music composition. Notably, some non-verbal communications established patterns in non-verbal behaviours that

contributed to the composition, e.g. Lesson One Episode Two, Ollie appeared to sit back and leave the work to his partner, as shown in the analysis (Chapter Five), but this was not the case. Contrary to what one would expect, this specific interaction was a sign of engagement. Ollie's orchestration of modes - gaze, body positioning and sound and his resources of modes - directionality of gaze, his angled body positioning and closeness to his partner, enabled him to easily see Alex's work, communicating his design for learning.

In Lesson One Episodes One and Two, Ollie chose to communicate using both digital and non-digital resources to identify key signatures, chords and motifs to complete the teacher's task. I analysed the data and provided my interpretation through the multimodal lens of transduction, a process that remakes meanings across different modes and multimodal texts. The pupils' use of digital and non-digital resources added complexity to understanding their learning. Despite this complexity, Unsworth and Mills (2020) and Djonov et al. (2021) suggested that understanding communication, whether a picture, text or digital media, requires considering both the physical appearance of the communication and the context in which it occurs. This perspective draws on multimodal discourse analysis theory. While transduction reveals the complexities of interpreting learning, it is not necessarily conducive to understanding learning within this study's context.

In continuing to explore the pupil's challenges in constructing meaning through transduction, I discuss further instances of the pupils deciding upon a key signature using available digital and non-digital resources (Lesson One, Episodes One and Two). In Lesson One Episode Two, Alex moved from writing or notating musical notes on the worksheet, which can be understood as a language-based semiotic resource (Martin, 2014), to playing them on the keyboard and then back to notating. The transcript showed that Alex was not wearing headphones which suggests his learning may have been limited as he foregrounded the modes of action and gaze over auditory stimuli. This meant that playing the scale on the keyboard may not translate to the correct notes of the chosen scale, and similarly, the played notes may not reflect the written ones. In contrast, Ollie wore headphones, and his semiotic actions (gesture, gaze and body

movement) suggest he heard and watched the scale being played. If Alex's playing were incorrect, it would almost certainly misguide Ollie's auditory understanding of the chosen key signature.

Alex's sign-making process of moving between notating musical notes and playing them on the keyboard highlights the practical challenges in constructing meaning through transduction. In Lesson One Episode Two, Alex's actions can be understood through Martin's (2014) theory, which proposes that using a language-based sign-system, such as notation, requires both the written note (signifier) and the sound representation of that note (signified) to be visible and audible in the sign-making process to enable learning and meaning to materialise. Martin (2014) and O'Halloran (2015) highlighted that a specific understanding of the rules and configurations is essential to correctly construct, for example musical notes and rhythms for key signatures and motifs. However, if Alex applied compositional rules incorrectly, there are meaning-making consequences for the pupils' composition and assessment.

In Lesson One, Episodes One and Two, Alex demonstrated active engagement in selecting modes to support his notation of the chosen key signature. This engagement involved the pupils transitioning between non-digital resources (worksheet) and digital resources (MIDI keyboard). However, the absence of auditory feedback due to not wearing headphones or not hearing the keyboard sounds indicated incomplete learning. This finding aligns with Martin's (2014) notion that both a visual and sound representation are necessary for effective learning. In contrast, Ollie visibly struggled with notation and relied heavily on the modes of gaze and positioning as he copied his partner's notation. His ability to independently complete the task suggested that additional teacher support, as discussed by Minott (2015), might have been beneficial.

Kirkman (2011) found that using worksheets with computer-based technology limited the pupils' compositional freedoms as they were required to attend to the teacher's directed task. Similarly, other existing literature on music education research identified that teachers' pedagogical choices impact the pupils' learning (e.g. Savage and Challis, 2001; Pitts and Kwami, 2002; Price and Savage, 2012). The process of transduction, as

discussed by Djonov et al. (2021), had the potential to hinder the development of multimodal digital literacy skills. However, the argument has less to do with the teacher's pedagogical framing, which was implicit through the expectations of pupils knowing the compositional rules and how to notate, and relevance towards understanding how their choices of modes and resources of modes helped them attend to musical notation.

Further examples of transductions often occurred as a direct response to the teacher's pedagogical framing, in which pupils moved across and in between digital texts and worksheets or from whole class input to computer-based technology. Alex's and Ollie's confusion became visible in their chosen responses, e.g. shoulder shrugs (Lesson Three Episode Five) and looking around at peers (Lesson Two Episode Six and Lesson Four Episode Four). After the initial teacher input at the beginning of Lesson Four Episode Four, Ollie's body positioning, gaze and action suggested that he was uncertain about how to proceed as he leaned on the desk tapping the keyboard. Although it seemed Ollie was waiting for his partner to return, it rather suggests that his full engagement in the task was reliant on Alex. These signs of engagement highlighted the pupils' agency and interests but also suggested they might not have the knowledge or resources to resolve what they needed to attend to.

This finding adds to existing literature (Dillon, 2003; Gall and Breeze, 2005, 2008; Breeze, 2011; Kirkman, 2011; Djonov et al., 2021) that questions the efficacy of computer-based learning when additional classroom resources are available. Breeze (2011) demonstrated that secondary school pupils achieved better learning outcomes when they had autonomy over their musical decisions rather than relying on teacher-designed software sequencer templates. Conversely, Djonov et al. (2021) highlighted that transitioning between digital and non-digital texts both facilitated and hindered learning. My study further underscores these findings by revealing that the analytical process of transduction for interpreting meaning-making, was not ideal. This limitation hindered pupils' effectiveness at completing standard notation when alternating between worksheets and digital resources. Consistent use of digital resources could have significantly enhanced their musical meaning-making and multimodal digital

literacy skills. Therefore, a more integrated digital approach may be more beneficial for learning.

A subsequent finding highlights the role of independent interests and actions in the pupils' engagement and their design for learning, as demonstrated by Alex in Lesson One Episode Two. In this episode, Alex leaned to his left, away from Ollie, and looked at the worksheet. Alex then moved to an upright position and refocused his gaze on the MIDI keyboard before he returned to his previous stance. His choices and orchestration of modes (gaze, body positioning, gesture, and action) indicated that Alex was highly motivated to learn and actively involved in the meaning-making process.

In this same episode, Alex's signs of learning meant he wanted to solidify his understanding, enabling him to interpret and make sense of the scale to complete the task. The analysis established that in Alex's semiotic actions, he did not direct his gaze nor glance toward Ollie, and neither did Alex gesture nor move his body position to invite Ollie to share the experience. This interpretation aligns with Bezemer and Kress' (2016, p.39) notion of 'the learner's own initiating action', in which learners show initiative and are self-driven to seek out and acquire knowledge or skills through their independent actions. Therefore, Alex's self-driven and independent actions signalled that he was not necessarily interacting, collaborating, or communicating much with Ollie. Alex's engagement was primarily solitary, which raises further questions about the balance between individual engagement and collaboration.

It was found that several other instances of non-verbal communication had similarities to Alex's intentions, where his prompt initiated his compositional interests. For example, in Lesson Two Episode Fifteen, Alex started the recording function on the software to record a motif, and in Lesson Three Episode Ten, he tried out different chordal patterns. In most instances, the extent to which the pupils engaged in the interaction highlighted their possible barriers to learning. This sign of engagement was often evidenced through Ollie's response to Alex's prompts, sitting back in his seat, watching and listening to his partner play the keyboard, e.g. Lesson Two Episode Six and Lesson Three Episode Twenty-five. Although Ollie was engaged, it highlighted his limited

knowledge of musical conventions (e.g. structures and styles) and suggested his learning needed to be shaped by 'others' (Bezemer and Kress, 2016), such as Alex or, in later episodes, the teacher (e.g. Lesson Four Episode Seven). Another explanation for Alex's initiation of his interests and actions could be that the prompt was never intended to benefit Ollie's meaning-making, confirming that Alex often chose to work independently.

The significance of a learner initiating their independent interests and actions, shown in this study's analysis, extended to instances of non-verbal communication in which speech acted as a preceding modal prompt (Lesson Three Episode Five), as well as when speech was not foregrounded or absent (Lesson One Episode Two). For example, in Lesson Three Episode Five, the preceding modal prompt foregrounded Alex's modes of gesture and speech as he turned his head away from Ollie and asked, '*How we gonna do this?*' and then alternated his gaze between the MIDI keyboard and computer screen. Ollie responded by orchestrating the modes of gaze, sound and gesture and muted three tracks in preparation for adding a movie marker. Comparatively, the preceding modal prompt for Lesson One Episode Two foregrounded the mode of action as both pupils attended to their notation worksheets. The pupils continued to work independently of each other even when Alex changed from notating to playing the keyboard. Consistent in these two examples is that their subsequent choices of modes not only ratified the preceding modal prompt but also showcased their independent interests and active engagement in learning.

This finding builds on music literature, whose research approaches to date have incorporated pupil talk with: non-verbal behaviours (MacDonald and Miell, 2000), communicational modes, such as visual and gesture (Gall and Breeze, 2008; Breeze, 2011), and relevant non-verbal actions (Dillon, 2003; Burnard and Younker, 2008; Mellor, 2008). Contrary to the traditional focus on speech as a precursor to non-verbal communication in music composition studies, my study established instances where non-verbal communication emerged independently, without any preceding speech. For example, in Lesson One Episode Seven, the preceding modal prompt synchronously foregrounded the modes of action and computer-generated sound, leading to a melodic

development for a character motif. Similarly, in Lesson Four Episode Forty-two, Alex and Ollie positioned themselves within direct sight of each other and the computer screen, allowing them to see and hear their work while the teacher observed from between them. The analysis confirms that non-verbal communication can stand alone as a significant form of communication, thereby expanding our understanding of the pupils' engagement in compositional work.

In carefully examining the data, the pupils' signs of disengagement became visible in their *ignored prompts*, indicating a failed attempt at non-verbal communication. One example showed Alex foregrounded the modes of gaze and action, signalling Ollie to stop playing the keyboard, as Alex tried out chords (Lesson Three Episode Ten). Ollie ignored the prompt and acknowledged the meaning of Alex's next glance after a three-second delay. As mentioned earlier, these signs of engagement and interest show learning when the pupils respond to each other's prompts (Bezemer and Kress, 2016). Therefore, a repercussion of this kind of detachment in pupils' communication may question whether pupils at Key Stage 3 would prefer to work independently like their peers in Key Stages 4 and 5 (Savage, 2010; Devaney, 2019).

There were five further instances of non-verbal communication in which Alex ignored Ollie's signs to communicate something. Each of Ollie's signs was different and attempted to communicate something specific towards his design for learning and contribute to the composition. Although I interpreted the data as Alex responding negatively to Ollie's prompts, his engagement continued to show signs of interest in the composition. For example:

- in Lesson Two Episode Six, Ollie's use of the keyboard communicated the beginnings of a potential idea for a motif;
- in Lesson Two Episode Fifteen, Ollie removed his own hands from the keyboard to attract Alex's attention; and
- in Lesson Three Episode Five, Ollie stopped the playback showing that *something* needed attention at that precise point in the composition.

On two further and separate occasions, Alex chose to ignore Ollie's contributions by physically removing his hand from the mouse and the MIDI keyboard (which will be discussed as a sign of control in Section 6.2.2). When the pupils ignored each other's prompts, this was a failed attempt at non-verbal communication, understood as being purposefully enacted. Interestingly, both pupils also ignored two verbal prompts given as part of the teacher's pedagogical framing aimed to support and direct the pupils' compositional tasks, shown in Lesson One Episode One and Lesson Four Episode Twenty-four. Ignoring prompts increasingly signified that the pupils had their own ideas and compositional interests, namely starting with a bassline rather than choosing a key signature in Lesson One.

The pupils' signs of engagement and interest were shown through transductions, learners being self-driven and following their interests, using digital and non-digital resources and ignoring prompts, all of which contribute towards the pupils' design for learning. Ignoring prompts confirms theoretical assumptions that the pupils' interests and agency shape their engagement on their own terms and given the circumstances of their own experiences (Kress, 2010; Bezemer and Kress, 2016). This behaviour demonstrates the pupils' interest and motivation (Kress, 2010; Kress and Selander, 2012) in working independently on the task, whereas engaging with the prompt indicates some form of interaction and contribution to the composition. The other pupil's recognition of the sign-maker's prompt revealed how the signs were interpreted as engagement, thus making the negotiation visible.

6.2.2 Signs of Control and Agency

From the analysis, three distinct signs of control and agency were identified: who had control over the musical substance and content of the composition, control of the computer mouse and MIDI keyboard and the pupils' non-verbal behaviours in controlling the actions and attention of another. These signs of control were not isolated phenomena but were interconnected. For example, a pupil would initiate a semiotic action, control the equipment and orchestrate semiotic resources to implement their idea, all while communicating this to the other pupil. In this context,

the varied signs of control and agency highlighted the complexity and multifaceted nature of non-verbal communication. Alex's and Ollie's signs of engagement and interests, their differing designs for learning, such as signalling intent (e.g. Lesson One Episode Eleven), directing attention (e.g. Lesson Four Episode Eleven) and asserting dominance (e.g. Lesson Three Episode Ten), led to varied musical understanding.

It was evident through the instances of non-verbal communication that there was an uneven distribution of *control* and *agency*, as Alex exhibited more controlling behaviours than Ollie. For instance, at the beginning of Lesson Four Episode Twenty-four, both pupils sat parallel to each other close to the desk. Alex orchestrated the modes of body movement, action and gaze to indicate his intent to contribute to the musical composition. In contrast, Ollie moved his arm out of Alex's way and repositioned himself by foregrounding the modes of body movement, gaze and sound. This interaction was interpreted in the analysis as Ollie's normal practice, as if he were giving consent or acknowledging that Alex was somehow in control over the musical substance of the composition.

Different modes of resources were brought together to communicate who had the musical ideas and who decided what material went into the composition. For example, Alex pointed at the computer screen and looked directly at his partner during Lesson Four Episode Eleven. This example builds on existing literature (Gall and Breeze, 2008), highlighting the importance of non-verbal communication, such as pointing at the computer screen, gestures and facial expressions, in conveying musical ideas and decisions. Alex's musical intentions were conveyed through this non-verbal behaviour, directing Ollie's attention towards the decisions being made about the composition without the necessity of verbal communication. The interaction of pointing further asserted Alex's dominance, seemingly marginalising Ollie's abilities as his gaps in musical knowledge became evident. The significance of this sign is similar to one reported by Rostvall and West (2005), where a pupil's emotional response to an expert's comments resulted in tears, as the expert elicited their control and power of knowing something that the pupil did not. The concern is amplified as potentially limiting the pupil's ability

to develop good musical reasoning and understanding (Rostvall and West, 2005). These 'signs of control' hindered at least one of the pupils' designs for learning, if not both.

Lesson One Episode Eleven, provided an initial example of a pupil asserting their dominance when Ollie invited Alex to listen to him play something on the keyboard. Towards the concluding moments of the instance of non-verbal communication, Alex responded by removing his headphones and moving away laughing. The analysis of the remaining lessons unequivocally indicated that Ollie did not play and/or contribute much to the composition's musical substance. Such a perspective enlightens us about the available semiotic interpretations, and as researchers and teachers, there is an opportunity to recognise and support pupils' knowledge gaps (Rostvall and West, 2005; Kress, 2010; Bezemer and Kress, 2016) whether through formative assessment, consequent intervention or through the pupils' preferred approach of teacher assurances (Minott, 2015).

In Lesson Two Episode Fifteen and Lesson Three Episode Ten, asserting dominance was evidenced in the pupils' choices of non-verbal modes, their resources of modes and their choices of equipment. For example, in Lesson Two, Alex used non-verbal communication to intervene and stop Ollie's MIDI keyboard playing by using gestures and gaze to reach over Ollie's arm to the mouse while watching the mouse's movement on the computer screen. This particular sign of control was directed explicitly at the other pupil and intended to disrupt whatever was happening. In this instance, the orchestration of Alex's modes resulted in a character motif being added to the composition.

In addressing the pupils' normal compositional practice, Alex demonstrated gaining control of the mouse by moving his arm over Ollie's in four episodes (Lesson Two Episodes Six and Fifteen; Lesson Four Episodes Eleven and Twenty-four) and once by controlling the MIDI keyboard (Lesson One Episode Seven). Ollie's response to this specific interaction was to move aside, sit back, watch and listen. Despite initial interpretations of Ollie's actions as disengagement or laziness, the analysis suggests that his response was an integral part of his design for learning. His semiotic actions

indicated that he was responding to Alex's prompts and actively participated in the tasks. Within this study's analysis, Alex's meaning-making links with the earlier notion of who controlled the musical substance and compositional content. In each of the five instances, Alex's orchestration of modes and transformations of resources led to the development of the composition. As such, the non-verbal communication ratified the preceding modal prompts, which theoretically confirms which modes supported their learning.

A more extreme manifestation of encroaching on someone else's personal space to operate the mouse was demonstrated in Lesson Three Episode Eighteen, in which Alex clearly signalled to Ollie 'not to do something' as he flicked Ollie's hand off the mouse. This finding aligns with Gall and Breeze (2008), who also highlighted the significance of control over the computer mouse in collaborative tasks. The notion of control seemingly complements findings of earlier studies that observed pupils, for instance 'seizing the mouse from another pupil' (Gall and Breeze, 2008, p.34; Breeze, 2011). Similar to Gall and Breeze (2008), this study found that control of the computer mouse was a critical factor in determining the flow of musical ideas and decision-making. The act of taking the mouse was reported as an example of when a pupil's role and collaboration became disjointed, signified by a learner taking control of the task or as a reaction to a verbal misunderstanding. In this study, the example foregrounds the significance of non-verbal communication that manifests as physical actions and how this contributes to a deeper understanding of the pupils' sign of control and agency.

Advancements in technology add to possibilities for improving the pupils' access to equipment and extend upon previous discussions about the restrictions with music technology and its equipment (Pitts and Kwami, 2002; Breeze, 2011; Wise et al., 2011; Himonides, 2012). Arising from this perspective are two insights. First, in what is to be considered the pupils' normal compositional practice, the non-verbal modes of communication provide researchers and teachers with insights into how to view the pupils' signs of learning. Second, within the context of my study, the analysis helps to show appreciation for some of the physical restrictions pupils' had in accessing the computer equipment as well as its impact on their learning.

The analysis of the four lessons established that Alex and Ollie always maintained the same seating position. The reasoning for this may have been associated with the teacher's pedagogical framing and classroom management in which pupils followed the teacher's seating arrangements. Further consideration for the set-up of the physical learning environment and conventions of how equipment is positioned at the workstation and in the classroom is required. Like Breeze (2011), the physical set-up of the learning environment played a significant role in these interactions, in which the manifestation of the pupils' role would either be natural or restricted. However, in contrast, Alex was seated on the left-hand side, furthest from the mouse (see Figure 5.1, p.123), which necessitated his reaching over Ollie. Decisions about workstation settings in the classroom environment are beyond the pupils' remit and to some extent, that of the teachers. However, from a multimodal social semiotic perspective, this means that the set-up has cultural relevance that will influence the pupils' designs for learning. Due to cultural decisions beyond Alex's control, leaning over Ollie in order to access the mouse exhibited his normal behaviour. What became visible across the lessons was a fluidity between the pupils' roles, which was based on their individual agency and interests in completing the tasks, regardless of who initiated the prompt. This finding is discussed further in Section 6.2.3 - Signs of Negotiation.

Therefore, signs of control and agency found in this study were intentional. They illustrated how technology could be used as a sign of asserting dominance or control in a computer-based compositional task. However, with a focus on the pupils' non-verbal modes of communication these actions become subtler and less disruptive to show how intent and directing attention can lead to varied musical understanding. Even with the absence of the mode of speech, the instances of non-verbal communication showed straightforward signs of learning and the impact these dynamics had on Alex's and Ollie's musical understanding and their contributions in shaping the computer-based music composition.

6.2.3 Signs of Negotiation

This study found that through the pupils' non-verbal embodied (e.g. gaze and gesture) and disembodied (e.g. layout of texts) modes, signs of negotiation were identified as mutual and fragmented agreements and the distribution of tasks. Several studies in music education have suggested that pupils can enhance their negotiation and compositional abilities through non-verbal behaviours and actions. Their findings primarily derived from pupil talk whilst focusing on collaboration (Dillon, 2003; Gall and Breeze, 2005, 2008; Huovinen and Rautanen, 2020) and conflict-based interactions (Hewitt, 2008). The discussion in this section extends the multimodal conceptualisation of learning (Kress and Selander, 2012) offering insights into how signs of negotiation are derived from different media, semiotic actions and non-verbal communications, thus contributing to the pupils' computer-based compositional learning.

In exploring the impact of non-verbal communication in computer-based music composition, the study illuminates the mechanisms through which pupils established mutual agreements and demonstrated conformity. For example, when the pupils shared similar compositional interests, such as creating a movie marker, as shown in Lesson Two Episode Thirty-three, they both used the modes of gaze and sound. These multimodal interactions contribute to the construction of visual and audible representations, leading to a form of mutual agreement. The study further extends the notion of conformity, as proposed by Huovinen and Rautanen (2020), by illustrating how it is enacted through the pupils' embodied and musical actions. The pupils' meaning-making process was evidenced by the foregrounded modes of gaze and sound and thus confirmed which of their decisions became accepted. This insight evidences the importance of understanding which non-verbal modes of communication can be foregrounded in fostering collaboration in computer-based music composition.

Some of Alex's and Ollie's signs of negotiation began as individual choices. These fragmented agreements were not single unified decisions but a collection of individual choices that gradually moved towards mutual agreements. For example, in Lesson Two Episode Nine, Ollie used a trial-and-error approach to find and select instruments as Alex

created a melody. The pupils negotiated decisions by orchestrating the modes of gaze, action and sound, in which sound became foregrounded in their final decision as it encapsulated the motif's essence and purpose.

In Lesson Three Episode Five, Ollie's attempt to contribute saw his efforts being undervalued by Alex, leading to a fragmented agreement and differing directions in their composition. With Ollies' intent to negotiate the insertion of a movie marker, he muted three tracks using the modes of action, gaze and gesture. Alex ignored this non-verbal communication and instead began to play chords using the modes of action and gaze, maintaining his interest and actions. In this instance, the pupils' misinterpretation of each other's non-verbal communication contributed to their designs for learning and evidenced how individual actions and decisions resulted in their composition developing in differing directions. Therefore, as Alex and Ollie did not always understand or correctly interpret each other's non-verbal prompts, the fragmented signs of negotiation were often ineffective, and any collaboration was minimal.

Additional signs of negotiation were evident in the distribution of tasks, highlighting how pupils shared their musical and technological skills to enhance their computer-based composition in a secondary school music classroom. The pupils' mutual agreements extended to include the use of equipment and their positioning at the computer workstation in which their signs of control and negotiation co-existed. There were many instances in which the pupils' actions of playing the keyboard and using the mouse meant their arms entered into each other's personal space (e.g. Lesson Two Episodes Six and Fifteen). Often, the affected pupil responded by moving backwards in their seat or removing their arm and hand from the equipment, thus allowing the other pupil access. This finding is reinforced by my earlier discussion on signs of control and agency (Section 6.2.2, pp. 353-357), which documented that negotiation occurred when one pupil complied with these signs and/or prompts, subsequently resulting in something musical happening (i.e. Lesson Three Episode Eighteen). The interpretation of the negotiation placed less emphasis on the physical restrictions of the equipment or the pupils' normal compositional practice, but instead on the quality of the composition and the individual

who had the compositional knowledge. This shift in focus directly impacted the composition, with the outcome mirroring Alex's knowledge more than Ollie's.

This finding expands on results of an earlier study that referred to secondary school pupils adopting one of two distinct roles, either computer operator or music keyboard player in which Breeze (2011, p.400) stated was mainly due to the pupils 'static seating positions.' Instead, the relationship between use of equipment and the pupils' positioning can be explained by the coordination of Alex and Ollie's actions and movements which also builds on Haviland's (2011; Section 2.9) notion of coordination of actions in an instrumental study by offering a computer-based and non-verbal perspective. However, in this context, the pupils' signs of negotiation facilitated musical features, such as adding chords, quantisation and movie markers (e.g. Lesson Three Episode Five), to the composition. This perspective allows us to see how the composition progressed through examining different patterns of interaction (Rostvall and West, 2003; Huovinen and Rautanen, 2020).

Through fine-grained analysis, I noticed that by the third lesson, Alex and Ollie had negotiated compositional roles for themselves, where Alex focused on composing the musical substance and Ollie the compositional editing. Their control of different semiotic actions, e.g. Alex recorded the motif and Ollie directed the editing, often led to the development of the composition whether they initiated the sign or responded to it. However, of the two pupils, I interpreted that Ollie tended *to have to negotiate* his engagement using modes of gaze, sound and body positioning as Alex focused on the composition. The analysis of Ollie's non-verbal behaviours in this episode (Section 5.4.1, pp.225-238) suggested displeasure as Alex ignored Ollie's actions of muting tracks in readiness to add a movie marker and then his submissiveness with his body positioning and lowering of his head as the episode progressed, indicating a fragmented agreement.

Earlier multimodal studies have highlighted the pivotal role of technology in shaping people's communication and interaction (West, 2011; Burn, 2017; Mroziak 2017; Poulsen and Kvåle, 2018). These studies generally agree that unfamiliarity with software and technology can impede pupils' learning. In this study, using the software and

computer-based technology was less problematic than, for example, understanding the purpose of some musical features, such as quantisation. Whilst technology shaped communication, the pupils' relationship also significantly influenced their design for learning especially when fragmented agreements were unresolved. Therefore, the pupils' semiotic actions informed their design for learning in the shaping and bringing together of musical ideas that contributed to the overall outcome of the composition. In these instances, the interactions and non-verbal communications of both pupils showed their meaning-making processes where signs of negotiation, mutual and fragmented agreements and the distribution of tasks supported the pupils computer-based compositional work.

6.3 The Pupils' Silent Semiotic Work as Signs and Designs for Learning

'The pupil that engages with the world around them is communicating meaning just by doing something and thereby, learning' (Bezemer and Kress, 2016, p.38).

In this section, I discuss the pupils' learning, their semiotic work and how the different signs of engagement and interest, control and agency, and negotiation became evident at different stages across the four computer-based compositional music lessons. Through the analysis, I mapped the pupils' multimodal processes as their modes and resources of modes were brought together (orchestrated) to transform and inform their designs for learning. The argument addresses the pupils' semiotic work as a sign of learning and communicates a design for learning.

Addressing the research sub-question, 'how do the modes involved in this non-verbal communication evidence learning,' the findings from the analysis substantiate that the pupils' semiotic work was not a random act but happened according to their agency of how they engaged, enacted semiotic choices and made decisions about which resources of modes to use. This is an instantiation of a design for learning. These transformative engagements build on the concept of '*sign*' and '*signs of learning*' as discussed in Section 6.2 and further examine how the pupils' semiotic work becomes visible.

6.3.1 Transformation of Resources as Signs of Learning

This subsection relates to *the transformation of resources* as an analytical tool to examine the pupils' interactions and as an interpretative tool to help me theorise how those interactions illuminate the pupils' compositional interests and their design for learning. It takes into account the social semiotic perspective of learning, as the resources drawn upon by the pupils were informed by their sign-making to assist in understanding and developing something. This is consistent with Bezemer and Kress' (2016) theoretical perspective of multimodal social semiotics and the notion of a semiotic chain (Kress, 1997).

The pupils' transformations of resources were evidenced by the numerous different ensembles and/or configurations of modes, demonstrating their compositional intentions and awareness of a design for learning. Each transformation revealed how the pupils subtly changed their chosen resources, which was identified as a sign of learning. For example, composing a motif created as a sign of learning, with the pupil's keyboard playing, and the resulting melodic sound resonated as evidence of their determination (e.g. Lesson One Episode Seven).

I found differences in whether the transformation of resources occurred once or multiple times during the pupils' instances of non-verbal communication and considered the significance of these changes. When the transformation occurred once, it typically lasted one or two seconds and supported the pupils' instant decision-making skills. For example, in Lesson Two Episode Thirty-three, Ollie foregrounded his gaze on the computer screen and pressed the spacebar on the QWERTY keyboard to stop the computer-generated sound from playing. In the next frame, the directionality of Ollie's gaze moved downward, and he again pressed the spacebar on the QWERTY keyboard, restarting the computer-generated sound. These short transformations of resources showed the coming together of differing non-verbal modes of communication in which the pupils made confident decisions and took action. The salience of this point shows how quickly learning materialised in the interaction.

In contrast, episodes with multiple transformations of resources highlighted the process of semiosis over time within the same episode. For example, in Lesson One Episode One, the first two transformations of resources showed Ollie responded to Alex's prompt using action and gaze to locate a new track icon and select a piano sound in GarageBand. Then, Ollie played the lower octave keys to explore a bass line, which involved a shift in his design for learning to focus more on action. Not only did Ollie demonstrate successful communication, but his transformation of resources, i.e. shifting from action, gaze and body movement to foregrounding a different action and direction of gaze, signalled his engagement in the compositional work, specifically exploring an idea for the bassline. These transformations provided insights into the pupils' problem-solving skills and the materialisation of learning.

Regardless of who prompted the change, the 16 episodes of non-verbal communication exhibited either short or multiple transformations of resources, leading to new signs of learning for one or both pupils. The aim was not to categorise the transformations but to understand how they occurred in the pupils' non-verbal communications and how any learning materialised as a result. The tables 6.1a and 6.1b summarise the pupils' transitional moments and the corresponding new signs of learning, provided as a musical or compositional description of what materialised at the point of change.

Table 6.1a: Summary of short transformation of resources

SHORT TRANSFORMATIONS

LESSON ONE EPISODES	One – Ollie invited Alex to rejoin the activity Two – Ollie listened to the computer-generated sound and watched his partner play (e.g. active listening) Seven - Ollie replicated Alex's musical ideas Eleven – Alex's moment of realisation and disbelief
LESSON TWO EPISODES	Nine - Pupils seemingly swapped activities as Ollie searched for an appropriate sound while Alex composed the first motif Thirty-three – Ollie identified a placement point in the composition for a movie marker
LESSON THREE EPISODES	Ten – Alex in contemplation Eighteen – Listened to the recording Twenty-five - The pupils located another potential movie marker
LESSON FOUR EPISODES	Four – Ollie visually searched for something in the composition Forty-two –Listened and reviewed their work with the teacher

In Table 6.1b, the number in brackets represents how many transformations of resources were found within the respective lesson and episode.

Table 6.1b: Summary of multiple transformation of resources

MULTIPLE TRANSFORMATIONS	
LESSON ONE EPISODE	One (3) – Ollie created a piano track, composed or experimented with a possible bass line, invited Alex to rejoin activity
LESSON TWO EPISODES	Six (3) – Ollie active listening. Alex made a decision using a visual search and put on headphones to explore a melodic idea. Fifteen (3) – Alex in contemplation, setting something up, put on headphones and recorded a motif
LESSON THREE EPISODE	Five (3) – Alex in contemplation, explored chord progressions, continued to foreground modes of action and sound, while ignoring Ollie’s cues
LESSON FOUR EPISODES	Eleven (2) - Ollie active listening while Alex listened and located a possible movie marker Twenty-four (2) – Ollie active listening and mischievous behaviour while Alex evaluated the composition (modes of sound and gaze)

The following discussion will examine the differences in the signs of learning, focusing on semiotic actions or the process of semiosis as significant at the time, moving from the shorter transformations to multiple transformations of resources. In the context of this study, these findings underscore the importance of understanding how the pupils’ interactions and non-verbal communications support or hinder their learning.

Although the transformation of resources in Lesson One Episode One is considered multiple, there is an anomaly of a short transformation that illustrated Ollie's rapid change in body posture from angled to upright in a fraction of a second. Ollie’s ensemble of modes, particularly the foregrounded body movement, signalled to Alex to rejoin the activity. Even though Ollie continued to play the keyboard, this was secondary to the meaning established by sitting upright. The short transformation of resources is significant as it highlights the importance of recognising that even a quick movement or pressing of the QWERTY keyboard spacebar contributes to the pupils’ design for learning.

In several instances of non-verbal communication, the analysis showed unexpected signs of learning, which implicitly shaped the pupils' design for learning. For example, disbelief through laughter (Lesson One Episode Eleven) was interpreted by how Ollie finished playing the keyboard, turned his head and looked directly at Alex. This instance led to a response from Alex, who coordinated his body movements and actions in a way that he took off his headphones and moved away from Ollie, all whilst laughing. Although intended to be humorous and foster collaboration, it inadvertently led to discouragement.

In another episode, Alex's intense focus (Lesson Two Episode Thirty-three) was foregrounded through his body language, gestures and gaze - resting both elbows on the desk, propping his head up with a hand formed into a fist, and covering his mouth. Alex's gesture, coupled with his forward-leaning stance towards the computer screen and his attentive gaze fixed on it, indicated a high level of focus. This non-verbal communication could provide the teacher with critical insight into recognising moments of deep concentration that may require support or space for autonomy.

Furthermore, Alex's and Ollie's embarrassment (Lesson Four Episode Forty-two), as shown by their facial expressions and hand gestures partially obscuring their mouths, served as a sign of embarrassment. Such expressions are often overlooked but can signal moments of vulnerability that may require teacher intervention and/or encouragement. Although these particular signs were *unexpected (i.e. embarrassment, laughter and disbelief)* they implicitly contributed to the pupils' cumulative design for learning and enriched the learning experience beyond showing any immediate musical learning.

According to Mehrabian (1981; Section 2.2), these particular examples could have been labelled as *non-verbal behaviours*, arguing that they provide insight into the pupils' dispositions. Conversely, Philpott (2016) defined learning to compose music as a process, suggesting that learning involves not just behavioural changes but also the acquisition and application of knowledge. Although these examples, such as disbelief, do not explicitly evidence musical learning, they imply its existence. In this way, the

pupils' non-verbal communications are responses to recent musical inputs and actions, thus suggesting the presence of musical knowledge.

Nevertheless, by adopting a multimodal social semiotic perspective of communication and learning (Kress, 2010; Bezemer and Kress, 2016), we can see how the pupils engaged and responded to these unexpected signs of learning as part of their social practice. This helps researchers and teachers to better understand pupils' decisions through their attitudes of disbelief and embarrassing emotions. Therefore, supported by the analytical process, the interpretations of these non-verbal behaviours are considered a subsidiary outcome and may warrant further research.

In contrast, episodes with multiple transformations signalled the pupils' problem-solving skills before they moved forward in their learning. For instance, in Lesson Two Episode Six, uncertainty about where to start the composition was shown by Alex, as seen by his slumped posture and unfocused gaze. Here Alex foregrounded the modes of head and body positioning at the desk with the directionality of his gaze. When Alex repositioned himself from slumped to upright, and his gaze became more focused on the screen, it signalled his resolution to the initial uncertainty. Similarly, in Lesson Two Episode Fifteen, Alex's hand gesture indicated a moment of contemplation before recording a motif. The interpretation of the resolved contemplation is evidenced through the differences in modes of body positioning at the desk (i.e. sitting back) and the removal of his hand gesture that covered his mouth. As discussed in Section 6.2 (p.345), these examples demonstrate Alex's internalisation of thought and extend upon Fautley's (2005) pre-generative stage of group composing. By applying the principles of recontextualization in the analysis, it robustly uncovered a deeper theoretical understanding of how non-verbal communication contributes to pupils' concentration and meaning-making.

The multiple transformations, although occurring sporadically in the episodes, show the continuous nature of the pupils' semiotic work, as per Kress's (2010) assertion that meaning-making is an ongoing social process. These transformations further made visible how the pupils used non-verbal modes of communication to progress from the

internalisation of a musical problem through the transformation of resources to enact a resolution, all whilst communicating their musical interest. Therefore, the pupils showed resilience and development of their knowledge as they moved from an unknown to a known entity. Transformations of this nature often emphasised that something new was added to the composition, e.g. creating a chord sequence.

The interpretations made in this study generally support the work of other studies in this area, linking broad compositional descriptions with computer-based learning. Here, for example, Kirkman (2011) could have considered multiple transformations as part of his second phase of extending and creating new ideas, whereas Minott (2015) may have emphasised it as a preparation stage. Even so, the pupils' complex signs of learning do not neatly fit into these descriptions, thereby implying that the concept of transformation of resources enables an in-depth examination and additional clarity to what non-verbal communication and compositional activities were occurring.

Whether the transformation of resources was a continual change or occurred once builds on existing multimodal social semiotic research by evidencing the significance of the pupils' choices in the classroom and through their engagement in the computer-based music composition. In the context of my study, the six instances of non-verbal communication with multiple transformations of resources evidenced learning, primarily through problem-solving. The transformation of resources showed that each pupil's signs and prompts were continually recognised by their partner, who reciprocated through non-verbal communication using gaze, gesture, action and/or body movement. Earlier classroom-based research iterated that it was not uncommon for transformations to be enacted quickly as a means to show the development of their participants' social semiotic work (Mavers, 2009; Kress et al., 2021). Therefore, the transformation of resources takes into account the task's *design*, the pupil's knowledge and how a pupil successfully engages in an activity (Bezemer and Kress, 2016).

The objects, tools and/or artefacts the pupils used (e.g. mouse or MIDI keyboard) and their function in supporting the pupils' compositional activities further shaped my interpretation of the transformations of resources as signs of learning. The

transformations often integrated the pupils' interactions with the mouse searching for something visual. Using the mouse orchestrated the modes of action and gaze as well as other modes, such as gesture, sound and movement, that occasionally became visible. As in previous studies (i.e. Gall and Breeze, 2005, 2008; Breeze, 2008, 2011; Mellor, 2008), the findings of this analysis further evidence the significance of how pupils operated the mouse. Not only does this finding include access to the compositional component of the task, but in addition, using the mouse required pupils to work across several multimodal texts, for example the Dr Who clip (BBC, 2012) and GarageBand, which in conjunction with the pupils' orchestrations evidenced complexity in the compositional activity.

One prominent example of Alex and Ollie using the mouse showed them focused on locating movie markers (Lesson Three Episode Twenty-five). First, Ollie used the mouse to mute irrelevant tracks, indicating which track (i.e. Dr Who audio) to focus on. The mouse was then used as a cursor to follow the sound until the resources of modes changed to action. Using the QWERTY keyboard, Ollie stopped the playback at the moment the pupils identified a possible position to add a movie marker. Afterwards, the mouse manipulated the identified track to create the intended effect. The example illuminates the pupils' design for learning in which the mouse facilitated their learning, but the non-verbal communication evidenced the pupils' knowledge of movie markers through their body positionings and movement. In addition to an earlier point about moving across and in between digital and non-digital texts (see Section 6.2.1), the example provides insights about the usefulness of analytical tools such as transductions and transformation of resources. Therefore, when two texts are digitally-based, there is some ease and continuity in learning and accomplishing the task.

6.3.2 The Pupils' Design for Music Compositional Learning

Key arguments presented in the literature (Section 2.4) emphasised that learning to compose with computer-based technology in the context of a UK secondary school music classroom remains a complex and multifaceted process. Notably, Webster (2011) questioned the role of technology in changing compositional processes and Breeze

(2011) advocated the perspective of computer-based compositional process over the product. However, from the perspective of multimodal social semiotic theory of communication and learning, computer-based compositional activities, particularly at Key Stage 3, remain a relatively under-researched area in music education. The analysis of the sixteen instances of non-verbal communication and the identification of different transformations of resources have shaped the pupils' design for learning during their compositional activities. This study's analysis has identified signs of engagement and interest, control and agency, and negotiation and the pupils' choices of modes and resources of modes to respond to their partners' prompts. These findings have been used to form theories about the pupils' learning and communication.

This thesis uses the theoretical perspective of multimodal social semiotics to define *learning* (Section 2.4) and *design for learning* (Section 3.4.2). This means that learning and communication are inextricably linked (Bezemer and Kress, 2016). Learning is a complex and interconnected process involving communication and social activities. It is where different signs of learning come together through the transformation of resources to demonstrate how pupils communicate and learn (Bezemer and Kress, 2016; Kress et al., 2021). As defined by Kress (2010), design for learning refers to an interpretive tool shaped by multimodal social semiotic theory and assumes specific coherence to understand participants' engagement, representation (depiction of ideas), and communication (exchange of ideas). Understanding the pupils' design for learning depends on their interactions and communication, rather than just the final product.

The transformation of resources provided a constant thread connecting the sign-maker's knowledge and their musical knowledge and/or involvement in contributing to the composition. Of the sixteen instances of non-verbal communication analysed, the findings indicated that when Alex and Ollie chose to *engage* with each other's initial sign(s), their semiotic actions enacted different aspects of the compositional tasks, i.e. trying out ideas for a bassline, exploring melodic motifs, recording a motif and trying different chord patterns. These activities share similarities with compositional processes reported in other classroom-based music composition studies (e.g. Kratus, 1989; Seddon, 2001; Dillon, 2003; Hewitt, 2008) and in this way are rather

unextraordinary. Nevertheless, by operationalising multimodal social semiotics, the study's analysis leads to in-depth insights of interaction, interpretation, and semiosis in creating music that evidences how two pupils in Key Stage 3 at a UK secondary school attend to these everyday happenings.

In considering computer-based music composition as transformative engagement, Alex and Ollie demonstrated varying degrees of compositional knowledge that consistently differed across the four lessons. Alex and Ollie were motivated by their interests and agency; their resourcefulness showed complex integration and weaving of modes with subtle nuances that indicated different kinds of knowledge. The different signs of learning came together to illustrate the outcomes of the transformations in which specific aspects of the composition were framed.

The pupil who initiated the sign for learning gained more than their partner as their non-verbal interaction and engagement created new materials or added something of value to the composition. For example, Ollie communicated his intention to test different instrumental and computer-generated sounds (Lesson Two Episode Nine). His transformation of resources showed a greater degree of focus and engagement in finding a sound to match a specific Dr Who character. In this instance, learning materialised when Ollie assigned an instrumental sound to one of the Dr Who characters. Through independent exploration or 'trial-and-error', Ollie contributed to the composition and his design for learning.

In music education, informal learning practices are well-documented (Green, 2001; Fautley, 2005; Biasutti, 2012) in which playing something known or taught can generate compositional ideas. The analysis showed two instances when the pupils played 'Someone Like You' by Adele (Lesson Four Episode Forty-two) and an unknown song in Lesson One (Episode Eleven). However, there was no further evidence of these ideas being incorporated into the composition. Even so, these examples were recognised as signs of learning through Alex's and Ollie's short transformations that showed their decisiveness as the activities flowed seamlessly from one to another, thus contributing to their design for learning.

The analysis regularly evidenced Alex's learning as a mixture of independent exploration, contemplation and determination, whereas Ollie rarely showed that level of enthusiasm. One example of Alex's signs of learning showed multiple transformations in quick succession of each other, as he tried different chordal patterns using three fingers to play three notes representing a triad (Lesson Three Episode Five). This illustrates the notion of independent exploration, in which Alex engaged with his musical ideas to discover different chordal patterns. In orchestrating the modes of action, gaze and gesture, Alex put his headphones on, positioned his right-hand fingers over different keys without pressing down, and fixed his gaze downward at the keyboard. Such actions demonstrate his contemplation and internalisation of thought as he prepared to play. With the introduction of the mode of sound, subtle changes in Alex's playing showed his finger positioning as more relaxed, as if he had confidence in his playing. Alex's design for learning moved quickly from his internalisation of thought and silent practising – to making a decision - to try out the chordal pattern with sound. The progression from silent practice to playing with sound highlights his ability to internalise and then apply his knowledge, thus demonstrating his design for learning.

In the context of the music lesson, instrumental skills such as chord fingering were readily recalled upon showing Alex's prior knowledge, for example before Episode Six in the second lesson. Arguably, creating a chordal sequence was defined in Lesson One Episode One as notation, which continued to develop through non-verbal communication as evidenced in Episodes Five, Ten, and Eighteen of Lesson Three. However, through independent exploration and contemplation, Alex tried different chord patterns by playing and hearing the chord sounds and practising the sequence without sound (fingering only). This method of practising with and without sound shows Alex's design for learning, which reinforces the notion of internalisation of thought and experimentation through his choices of modes and transformations of resources. At the final point of transformation, the chords were recorded in Episode Eighteen of Lesson Three, suggesting his determination and signifying the culmination of his design for learning, in which his determination led to a tangible outcome.

Alex enacted similar signs of learning in developing the leitmotifs and background music, although the ensembles of modes were different according to his choices. Through the modes of action, playing the keyboard, gazing and looking at the keyboard, Alex communicated his interpretation and knowledge of what a motif was and how to create one, as in Lesson One Episode Seven. The mode of sound signified a change in the meaning-making process from trying out - to constructing - to recording. Added to this ensemble of modes, the modes of action, pointing with the mouse and gazing at the Dr Who clip (BBC, 2012), contributed to the positioning of the recorded track. This semiotic process was significant to Alex's design for learning and closely aligns with multimodal social semiotic theory (Bezemer and Kress, 2016, p.39), and particularly illustrates Alex's self-driven behaviour in seeking out and acquiring knowledge, or skills through his independent actions. As a result, Alex's semiotic work simultaneously shaped Ollie's learning.

These findings evidence the importance of creating an environment that encourages independent exploration and engagement. Alex's ability to transform his signs of learning into tangible outcomes showcases his design for learning. It further demonstrates that skills and musical development will occur when pupils are given the autonomy to experiment and reflect.

Ollie's interests and pre-existing knowledge were often evidenced through changes in his arrangement of body positioning and facial expression, i.e. when he heard something he liked (Lesson One Episode Seven and Lesson Three Episode Eighteen). Interestingly, the analysis of these two specific episodes shows that Ollie's preceding modal prompt consisted of a verbal utterance, which later became ratified through his orchestration of additional non-verbal modes of communication. The change of resources within these two modes – body positioning and facial expression - signified Ollie's approval but also indicated he recognised something was melodically suitable for one of their leitmotifs. This interpretation reiterates Haviland's (2011) observation of body movements in instrumentalists, where the mode of sound foregrounds the meaning. Therefore, Ollie's response to the mode of sound was similar to a musician's natural movement when playing, prompted by non-verbal behaviour of arousal or pleasure

(Mehrabian, 1981). It not only showcased Ollie's knowledge but further persuaded his partner to continue trying out similar melodic ideas, suggesting progression towards the composition.

Ollie's communication can be understood as his commitment and engagement in Alex's ongoing keyboard playing. Learning became salient in Ollie's continued choices of non-verbal modes of communication through his positioning (seated and angled towards Alex) with his gaze focused on the keyboard while concurrently listening, for example in Lesson One Episode Seven. These complex signs of learning represent the pupils' musicality offering the researcher and teacher an alternative understanding of one pupil's seemingly inactive contribution to the composition. Therefore, these instances orchestrated by the modes of positioning, gaze and sound are specific to Ollie's design for learning.

Research of computer-based music composition has noted that pupils were able to negotiate their compositional ideas through the computer screen using modes of speech and gesture (Gall and Breeze, 2005, 2008) and how onscreen mouse manipulations represent a partial view of the participant's compositional process (Mellor, 2008). However, these findings do not necessarily account for the pupils' learning that may have occurred off-screen or exclusively in the pupil's non-verbal communications. Firstly, I analysed the pupils' resources of the visual mode to understand the directionality and intensity of their eye gaze, e.g. whether they were glancing or staring at each other or specific objects. Secondly, from within the classroom as a researcher or teacher, looking at the computer screen shows restrictions in ascertaining the pupils' learning. These restrictions were documented in the first and last screenshots, such as Lesson One Episode One (Section 5.2.1, p.128). The analysis of these screenshots showed no visible differences or changes to the composition between the beginning and end of the instance of non-verbal communication.

Ollie often directed his gaze towards Alex which highlights the importance of visual cues and his ability to use these signals to coordinate his actions with Alex. This was evidenced in Lesson One Episode Eleven, as Ollie waited for Alex to be ready to listen to

him play something on the keyboard. The foregrounded visual mode was significant in Ollie's communication, as it showed his intention and realisation confirming that there were other routes into his learning. Consequently, Ollie's interaction demonstrated his use of visual cues to know when to start playing, an understanding often linked to musical performance (MacDonald and Miell, 2000) and the coordination of another's actions (Haviland, 2011), indicating prior musical knowledge. During Ollie's performance, his gaze focused on positioning his hands on the keyboard notes. The analysis of Ollie's choice of modes conveys hesitancy in knowing the piece well or perhaps to aid his confidence in playing correctly.

Secondly, the analysis of the sixteen episodes' first and last screenshots rarely showed any crystallisation of learning. At best, the screenshots illustrated when the pupils had added a compositional element, such as a recorded track in Lesson Two Episode Fifteen. Whilst in a classroom environment, although we can visualise and check any compositional development, we cannot see the entirety of the pupils' design for learning from the screenshots alone. Although Breeze (2011) advocated a change in the way teachers assess composition by analysing the process, he also suggested that the experimental phase encompassed numerous musical changes that may not be evident in the final piece. Accordingly, this study's analytical framework, specifically generating and framing data through mappings (lesson overviews and episodes, Section 4.5) and operationalising the principles of recontextualization, evidenced a level of detail missing in the current literature. This framework provided insights into the significance of the pupils' non-verbal communication that emphasised their design(s) for learning. Therefore, as researchers and teachers, we need to extend our pedagogies and strategies to understand that there is depth to pupils' learning, particularly in their non-verbal ('silent') communication.

Not all transformative engagements positively supported the pupils' design for learning. I interpreted some meanings from the instances of communication to show negativity (Lesson Four Episode Twenty-four), which instead of aiding the pupils' signs of agency and interest, seemed to have a contradictory effect on whether new learning materialised. On two occasions, Alex foregrounded body movements as a sign of

disengagement, such as retrieving headphones (Lesson Four Episode Four) or simultaneously removing headphones and moving away from the desk in Lesson One Episode Eleven. However, whilst Alex intended to complete a successful composition, these instances detracted from his learning in terms of wasted time.

6.4 Chapter Summary

This chapter has examined how the sixteen analysed instances of non-verbal communication, including silence, substantiate musical and technological learning in computer-based music composition. These instances of non-verbal communication showcase the pupils' signs and designs for learning. Understanding non-verbal ('silent') communication is significant in how both embodied and disembodied modes contribute to pupils' musical learning. I have established that a complex interwoven relationship exists between the pupils' different signs of learning:

- engagement and interest;
- control and agency; and
- negotiation.

Each sign for learning signifies different possibilities for understanding and enhancing the pupils' designs for learning. For instance, an uneven distribution of control leads to an unbalanced impact on learning regardless of the roles the pupils adopted. The findings further identified potential obstacles in the transduction process that could affect the compositional work. This means that understanding and addressing the challenges in the pupils' choices of modes and resources of modes and how pupils convert information from one form to another, could improve their learning.

The second section (Section 6.3) established that learning materialised through pupils' different orchestrations of modes in which short or multiple transformations of resources offered contrasting perspectives on how their work became meaningful. As a result of the transformation of resources, independent exploration, trial-and-error, and informal learning became apparent approaches. Other non-verbal behaviours such

as contemplation, determination and disbelief also became visible and supported the pupils' design for learning.

The originality of the thesis lies in how the study operationalises selected concepts of multimodal social semiotic theory of communication and learning to make visible the pupils' non-verbal communications in computer-based music composition at Key Stage 3. This approach offers a new and in-depth perspective on how pupils' signs of learning contribute to their design for learning while creating a computer-based music composition.

The concluding chapter (Chapter Seven) summarises my study and considers the thesis' contribution to knowledge, the implications for using a multimodal social semiotic approach in music education, the study's limitations, and possible directions for future research.

7.0 Chapter Seven: Conclusions and Recommendations

7.1 Introduction

The concluding chapter synthesises the implementation and operationalisation of Kress' (2010) and Bezemer and Kress' (2016) multimodal social semiotic theory of communication and learning. This theory provided an in-depth approach to analysing the computer-based compositional work of two Year 9 pupils during their instances of non-verbal ('silent') communication. Section 7.2 summarises this study in relation to the research aims and addresses the overarching research question: *What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?* Section 7.3 evaluates the contributions of this thesis to the existing body of knowledge in the fields of multimodality and music education. Section 7.4 examines the implications of this study by drawing on the pupils' designs for learning in computer-based compositional practice and its impact on secondary school music teachers. Section 7.5 acknowledges this study's limitations. The concluding section (7.6) identifies potential avenues for future research.

7.2 Summary of the Thesis

This study aimed to analyse and make visible the semiotic work of two pupils through their instantiations of non-verbal communication as they engaged in a computer-based compositional task as a part of their normal music lessons. The study was conducted in a UK secondary school with Year 9 pupils in Key Stage 3. I observed and videoed four sequential music lessons in which Camtasia (a screen capture program) captured two pupils' (aged 14-15) work-in-progress. To create the data set, I operationalised concepts from Kress's (2010) multimodal social semiotic theory of communication and then applied the theory and the principles of recontextualization (Bezemer and Kress, 2016). The video-based observations created lesson maps that provided an overview of all instantiations of non-verbal communication. Among these, sixteen significant instances of non-verbal communication were selected for an in-depth micro-analysis. Each map differed and showed how the pupils' choices of modes from speech, actions, gaze, gestures, facial expressions, movement and sound were foregrounded and how their

resources of modes gave value and richness to understanding their learning and communication.

Main Research Question: *What is the significance of non-verbal communication ('silence') in the pupils' compositional moments?*

The study found that non-verbal communication, particularly silence defined as the absence of the mode of speech, plays a significant role in pupils' computer-based music composition. Silence is complex and context-specific, encompassing diverse meanings and contributing to the pupils' semiotic actions. This research highlights the importance of understanding these non-verbal moments to gain in-depth insights into pupils' meaning-making and engagement with their learning.

Sub-questions:

a) What is 'silence' significant of?

As a former music teacher, I was curious about what pupils were learning when they stopped talking, which provides the rationale for this study. From a multimodal social semiotic perspective, silence is a form of communication with intrinsic value. It is not banal or arbitrary; instead, it reveals the complexities and richness of pupils' meaning-making. Silence also acts as a framing device that establishes boundaries for non-verbal communication. Framing was the first of four principles of recontextualization (Bezemer and Kress, 2016), which supported the transposition of theory with the data and analysis of the mappings to locate the pupils' design for learning. This framing allows for a detailed examination of how pupils engage with or ignore signs. The findings indicate that '*silence*' was significant of the pupils' signs of engagement, interest, control, agency, and negotiation. By analysing these signs of learning, we can gain a deeper understanding of how non-verbal modes of communication reflect on and shape the pupils' engagement in computer-based music composition.

b) What kind of semiotic work happens during instances of non-verbal communication?

During the pupils' instances of non-verbal communication, they engaged in semiotic work by selecting and using various modes and resources of modes, such as gaze and its intensity or directionality. This process created signs of learning and, when analysed through the process of transformation of resources, revealed the ongoing exchange of ideas. The pupils' resourcefulness in choosing appropriate modes demonstrated diverse signs of engagement and interest, control and agency, and negotiation. It was evident through their non-verbal communication that they experienced a range of emotions. Signs of disengagement and discouragement were clear, along with moments of embarrassment and disbelief. I could sense the pupils' frustration, for example through the tension and placement of Alex's hand gesture and fixed gaze (Lesson Three Episode Ten; Figure 5.9), but also saw their attention was focused on the task. These signs convey meaning, demonstrate the pupils' understanding, and facilitate interaction with the task, thus allowing them to compose.

c) How do the modes involved in this non-verbal communication evidence learning?

The non-verbal modes of communication provide various resources for meaning-making. Each mode, such as speech, action, sound, gaze, gesture, facial expression, and body movement, offers unique possibilities and limitations. These modes allow pupils to create and convey meaning through their choices and configurations within the context of the Key Stage 3 music classroom and computer-based compositional practice. By viewing pupils as sign-makers, their learning is demonstrated through their orchestration of these modes, showing how they engaged with and interpreted the compositional task. This highlights the importance of drawing on specific concepts from multimodal social semiotics in computer-based music composition, as the mappings, principles of recontextualization and transformation of resources enable a deeper and more comprehensive understanding of the pupils' design for learning.

For example, in Lesson Two Episode Nine, the pupils orchestrated the modes of sound, action and gaze to find a suitable instrument to represent a character's motif, which was included in their composition. Orchestrations of body positioning, body movements and gaze often conveyed the pupils' emotions and whether they were interested in and engaged with their compositional task. The pupils could coordinate and synchronise their efforts while using different orchestrations of modes and transformation of resources to create musical elements, such as chords, background music, or complete editing features like quantisation and implementing movie markers. Equally, these same orchestrations and transformations highlighted whether the pupils preferred to work individually, provided insights into the dynamics within the pairing, their musicality and their designs for learning. Taken together, this helped the pupils to communicate their musical, compositional, and technical ideas more vividly. Multimodal social semiotics views learning as communication seen through the pupils' choices and orchestrations of modes and specifically their transformations of resources. This offers a new way of understanding what is taking place during pupils' computer-based music composition.

7.3 Contribution to Knowledge

My study is positioned at the intersection of multimodal communication and music education and, therefore, contributes to the research fields of multimodality and computer-based composition in music education. By highlighting the pupils' designs for learning in their non-verbal communications, I contribute to a growing body of knowledge about computer-based music composition at Key Stage 3 for pupils in UK secondary schools (Sections 2.5; 2.10.1). This research study is one of a few studies to operationalise Kress' (2010) and Bezemer and Kress' (2016) multimodal social semiotic theory of communication and learning, and then transpose the theory to examine, analyse and interpret signs of learning in the pupils' instances of non-verbal communication. The significance of non-verbal ('silent') communication in the pupils' semiotic work builds on a small but representative body of multimodal literature on silence (Section 2.3.2), adds to new knowledge on non-verbal communication in music education (Section 2.2.1) and how non-verbal communication can be rationalised and

examined (Sections 4.3.2; 4.5). Therefore, the work presented in this thesis establishes how instances of non-verbal ('silent') communication evidences learning in the pupils' ongoing cycle of interaction, sign-making and transformative engagement during their computer-based compositional activities.

Through this study's analysis (Chapter Five) and discussion (Chapter Six), I have established that the pupils' signs of learning materialise through different orchestration of modes and provides various insights into their musical experiences. Bezemer and Kress (2016, p.50) state, 'with every sign made, the sign-maker's knowledge is transformed', and my study recognises the value of the pupils' transformative engagement as a means to understand how non-verbal modes of communication evidence their designs for learning. I am substantiating that through their instances of non-verbal communication, specifically in the pupils' transformation of resources and other signs of non-verbal communication, we can see evidence of both pre-existing and newly generated knowledge that shapes the pupils' design for learning. Accordingly, these designs incorporate signs of learning of engagement and interest, control and agency and negotiation which are recognised as supporting the pupils' approaches to composing. These approaches include informal learning, independent exploration, trial-and-error, contemplation, determination and disbelief that give us, as researchers, a deeper understanding of their musical and technological abilities.

Instead of examining the final compositional product and by asking questions about the pupils' social semiotic process, we gain an extensive multimodal social semiotic account of learning rather than one focused solely on learning outcomes. The different signs of learning, for example, interest, control and negotiation, and other non-verbal communications, such as disbelief and enthusiasm, come together to show the pupils' agentic engagement through their choices of different resources. The analysis established that the pupils are learning as their engagement with non-verbal modes communicates meanings and provides indications of how and why they are designing their learning. Therefore, as researchers and music teachers, we need to diversify how we examine learning and be open to the fact that non-verbal ('silent') communication provides positive and valuable insights into the pupils' designs for learning.

Methodological Contribution

My study's methodological framework provides 'inroads' (Bezemer and Kress, 2016) to examining pupils' instances of non-verbal ('silent') communication rather than using speech which is considered the dominant analytical approach in music education. In this respect, my research interests share similarities with a new and growing trend in multimodality and music education in which studies are beginning to prioritise learner's communication through their non-verbal actions rather than language (e.g. Lim, 2019; Pitt, 2023). As researchers and music teachers in a classroom context, we are often restricted in obtaining a complete picture of pupils' semiotic work as the positioning of the computer workstations provides views of pupils' backs with headphones, thus limiting access to facial expressions, gestures and computer-generated sound.

In alignment with Breeze's (2011) perspective, my study supports the view that examining the final product in computer-based music composition can obscure the richness of how the pupils compose (Sections 2.4.2; 6.2.1; 6.3). For instance, the analysis (Chapter 5) incorporated screenshots to document the beginning and end of the pupils' non-verbal interactions. The findings suggest that relying only on the computer screen for assessing pupils' learning provided an incomplete picture, as it demonstrated that significant non-verbal communication and learning occurred beyond what was captured and visible on the computer screen.

In multimodality, video is a resource for data construction, not the actual data (Erickson, 2006). Using video-based methods, the transposition of multimodal social semiotic theory and the principles of recontextualization allowed me to access these modes and the pupils' semiotic work, providing my interpretations of the pupils' design for learning. My study analysed the pupils' experiences of social interaction and communication through the activities they chose to engage in. The pupils' design for learning during their instances of non-verbal communication may convey greater insights into the process over the product, potentially extending beyond the expectations outlined in the teacher's Scheme of Work, pedagogical methods, or assessment practices. Whilst classroom layout can contribute to the issue at hand, addressing this aspect is beyond

the scope of my current study. Instead, I focused on methodological and analytical insights, offering a contemporary approach to examining pupils' multimodal social semiotic processes in computer-based music composition. This perspective underscores the importance of valuing the learning journey as much as the outcome.

The detailed mappings of the pupils' resources available for communication (Chapter Five) were crucial to responding to two out of three research sub-questions:

What kind of semiotic work happens during instances of non-verbal communication?; and how do the modes involved in this non-verbal communication evidence learning?

In the context of my study, the maps offer a visual representation of the decisions the pupils' made, for example directionality and intensity of facial expressions and gazes, making explicit their signs of engagement and compositional interests. Therefore, these maps and their subsequent analysis enabled clear insights into the pupils' signs of learning, including their decisions on resources of modes and how to compose.

7.4 Implications for Practice

Section 7.4 considers the study's implications by focusing on the significant role of pupils' non-verbal communication and its implications for practice, specifically for secondary school music teachers.

This study explores the often-overlooked role of non-verbal communication in computer-based music composition, in which the findings suggest two interrelated implications for secondary school music teachers' practice. The current focus on artefacts or texts (Kress and Selander, 2012; Bezemer and Kress, 2016; Jewitt et al., 2016), such as scores and soundtracks, as evidence of learning may detract from understanding the meaning-making process itself. This emphasis might influence a teacher's pedagogical framing and the types of musical knowledge that are valued. By examining pupils' ongoing non-verbal communication and transformations of resources (Bezemer and Kress, 2016), this study suggests two implications. First, shifting pedagogical practices should recognise and incorporate non-verbal modes of

communication as evidence of learning; second, adopting a broader understanding of musical knowledge that values pupils' complex signs of learning as much as the final product.

Examining pupils' non-verbal modes of communication reveals different aspects of their compositional work, highlighting the need for music teachers to move beyond the expected learning outcomes and strict adherence to UK policies (i.e. Model Music Curriculum for Key Stage 3, DfE, 2021; National Plan for Music Education, Crown, 2022). This study has established the value of making the invisible visible through pupils' choices and use of modes and resources of modes (Bezemer and Kress, 2016) in learning to compose. One implication of this study is that it opens new research avenues or approaches to studying non-verbal communication among pupils. It further highlights the need for music teachers to revise definitions of learning to compose and align them more closely to the demands of our contemporary digital environment.

I have established that if we interpret communication and learning as intertwined and indivisible entities (Bezemer and Kress, 2016) and view the world from a multimodal social semiotic perspective, then multiple signs of learning become visible. These signs illustrate the pupils' musical, technical and social learning. This approach could allow for a more comprehensive understanding of pupils' learning, which in turn could potentially influence teachers' pedagogy or curriculum design. For instance, in paired work, every sign enacted by one pupil can be interpreted by the other. However, as discussed in Chapter Six, this interpretation only occurs if the *other pupil* engages with prompts. The approach shows a complex unravelling of the orchestration of different modes and resources of modes, creating many different designs to help the pupils create their composition.

This study confirms that silence is crucial in supporting pupils' communication, learning and developing their musical knowledge and compositional skills. We know this as the analysis of the pupils' instances of non-verbal communication showed many signs of engagement and interest, control and agency, and negotiation during the computer-based compositional task. Furthermore, the pupils' learning became visible through

different orchestration of modes in which short and multiple transformations of resources showed their designs for learning.

In this context, and consistent with a social semiotic account of learning, each pupil's sign of learning provided insights into their musical and technological capabilities. Non-verbal communication influenced pupils' choices of modes and resources of modes, leading to either short or multiple transformations. These changes evidenced learning from pre-existing musical knowledge (short transformations) or new, task-specific skills (multiple transformations). This materialisation of learning testifies to the pupils' design for learning, highlighting their resourcefulness through iterations, such as creating and recording motifs, adding chords, and locating movie markers.

This implies that non-verbal ('silent') communication is not merely an absence of speech but a powerful pedagogical tool that can enhance the learning environment. By recognising and utilising non-verbal communication, music teachers can better support pupils' engagement, autonomy, and collaborative skills, leading them to a deeper and more nuanced understanding of computer-based music composition.

7.5 Limitations of the Research

This study acknowledges three potential limitations. The first limitation arises from utilising and applying selected concepts from multimodal social semiotic theory of communication and learning (Section 7.5.1). The second limitation concerns the selection of modes of communication studied (Section 7.5.2). Lastly, my engagement in the research process as a researcher and former music teacher is examined for potential biases (Section 7.5.3).

7.5.1 Methodological Choices

The work of Kress and Selander (2012) initially considered designs for learning from the teacher's and/or pedagogical perspectives by examining the expected learning outcomes against the classroom activities and the availability of semiotic resources. This

study adopted their established definition of design: As the planning of something new to happen, the shaping of products, and the shaping of social interaction (Kress and Selander, 2012, p.266; Section 3.4). Then, the application of the definition focused on both the pupils and how different orchestrations of modes influenced their designs for learning. In this way, a multimodal social semiotic approach is an apt theory to enhance teachers' practice by understanding the complexities and value of non-verbal communication in pupils' learning.

A video-based design, similar to Heath et al. (2010), supported this study's methodology and analytic framework in demonstrating the pupils' computer-based semiotic work as a whole, making visible their learning, and was replicable and rigorous enough to substantiate my claims. It reduced the initial limitations often faced by researchers, such as the physical layout of computer workstations in which teachers often experience a rear-view of their pupils, and provided access to the orchestrations of modes, e.g. sound, gestures and facial expressions.

However, this approach cannot be directly applied to classroom practice because it relies heavily on technology and faces practical limitations with Camtasia software. These limitations may include concerns about cost, intrusiveness and technical expertise. In a classroom setting, installation of Camtasia on multiple computers is unlikely, thus limiting the number of pupils' work that can be captured and examined. Some pupils might find Camtasia plus a video camera (with or without an observer) quite intrusive, and their presence may lead to altered behaviours rather than clear insights into what may be considered their *normal* compositional practices. Recording pupils in the classroom setting also raises important ethical concerns about privacy and consent. Lastly, the recording equipment or software itself may affect the quality and completeness of the data collected.

These limitations highlight some challenges in applying a video-designed approach. While there are many practical applications associated with using Camtasia software in generating and framing data (Section 4.5) and with the analytical process, such as transcription (Sections 4.5.1; 4.5.2; 4.6), using multimodal social semiotics in practical

computer-based music classroom settings is likely to be too time-consuming for teachers. Therefore, it may be beneficial to consider alternative methods for capturing data on pupils' computer-based music composition practices. Should this approach be adopted, providing adequate training and support would be necessary.

7.5.2 Selection of Modes

In my study, the modes of speech and written text were consciously de-emphasised during the analytical process. The decision was driven by curiosity about the potential learning opportunities during pupils' instances of non-verbal ('silent') communication, stemming from my experience as a former music teacher. The multimodal social semiotic theory of communication and learning was adopted, which provided methodological solutions and a theoretical framework that enabled the application of concepts to the selected instances of non-verbal communication. From the perspective of multimodal social semiotics, non-verbal ('silent') communication was defined as the absence of the mode of speech. The assumption was that non-verbal communication would become more apparent in the pupils' learning when speech ceased.

This approach challenges the traditional view of language as the central mode of communication, highlighting the value of other semiotic resources (Bezemer and Kress, 2016, pp.6-7). According to Jewitt et al. (2001), while language is present, it is not always the primary focus; it is one of many modes that can be foregrounded or backgrounded depending on the context. This perspective enabled the exploration in how two pupils used non-verbal modes, such as gestures, gaze, body movement, actions and the music itself, to communicate and create meaning. While acknowledging that omitting certain modes can potentially limit the scope of a study and possibly introduce bias in the analysis (Chapter 5), this step was necessary to maintain a multimodal social semiotic theoretical perspective, the research design and the phenomenon being studied.

The theoretical perspective of multimodal conversational analysis, as used by Mondada (2019) to study pauses, gaps, and lapses in speech, could have been adopted to analyse the pupils' silent actions and communication. However, the implications of this

approach would have highlighted the importance of both verbal and non-verbal elements in understanding communication dynamics. Further, this approach would have reduced the time available for a fine-grained analysis of how different non-verbal modes of communication were orchestrated and transformed in this context. Both of these points are counter to the focus of this study.

7.5.3 Reflexivity

Both theoretically and practically, critical engagement with the research process was essential. I was a part of the data construction and the analytical process, and as such, I constantly questioned methodological decisions. I maintained a researcher's journal (Section 4.4.5) and consistently reflected on the research process, generation and framing of the data and positionality of my participants (Section 4.8). However, in recognising my former experience as a music teacher, I acknowledged my subjectivity in my interpretation of this research. This awareness is critical in guiding the methodological rigour. To attend to this limitation, I endeavoured to remain open and transparent about my methodological and analytical decisions while ensuring that the most appropriate analytical and interpretative tools from the theory of multimodal social semiotics were applied and operationalised in this study.

7.6 Possibilities for Further Research

To date, my research has made a modest impact on the wider research community at the Music, Education and Technology Conference (MET2018), Research in Music Education Conference (RiME, 2023) and the International Conference of Multimodality in London (11ICOM, 2023). On these occasions, scholars of multimodality and music have recognised a gap in research on Key Stage 3 pupils' music education in UK secondary schools and have noted the innovative nature of adopting a multimodal approach to examining non-verbal communication. Extending this research could involve analysing additional instances of non-verbal communication in computer-based music lessons. The methodological and analytical approach outlined in Chapter Four

could be replicated in other secondary schools, for example by focusing on one school for a longer period or introducing different pupil pairings.

Given the practical and pedagogical implications of my findings, there are two natural progressions for my study. The aim could be to develop teachers' pedagogical framing by obtaining their understanding of how learning is shaped by instances of non-verbal communication, as well as strategies to support pupils' compositional development during their multiple transformations. The application of multimodal semiotic social frameworks in music education could be extended by operationalising Bezemer and Kress' (2016) principles of recontextualization and their theory of assessment to explore pupil progression. There is an opportunity to open a debate with researchers and music teachers to move forward on the significance of non-verbal communication as providing further valuable insights to the pupils' designs for learning. Future research could be collaborative, working with music teachers and/or trainee teachers to explore how to utilise non-verbal ('silent') communication to provide them with a greater understanding of the pupils' signs of learning that influence and shape their designs for learning.

References

- Apple Incorporated. (2017) GarageBand Mac. [Computer program]. Available at: <https://www.apple.com/uk/mac/garageband/>. (Accessed 1 January 2016).
- Aubrey, K., and Riley, A. (2018) *Understanding and using educational theories*. 2nd ed. London: Sage.
- Barthes, R. (1967) *Image, Music, Text*. Reprint, London: Fontana Press, 1987.
- Bassey, M. (2010) 'Case Study Research in Educational Settings', in P. Sikes (ed.) *Doing Qualitative Research in Educational Settings*. Buckingham: Open University Press.
- Basso, K.H. (1972) 'To give up on words: Silence in western Apache culture', in P. Giglioli (ed.) *Language and social context*. Harmondsworth, UK: Penguin.
- Bateson, G. (1979) *Mind and Nature: A Necessary Unity*. New York: E.P. Dutton.
- Bath Spa University (2014) *Handbook on Research Integrity and Ethics*. Available at: <https://thehub.bathspa.ac.uk/services/research-and-graduate-affairs/graduate-college/integrity-and-ethics>. (Accessed: 2 September 2015).
- Battersby, S.L. (2009) 'Nonverbal Communication: Increasing Awareness in the General Music Classroom', *General Music Today*, 22(3), pp.14-18. doi: 10.1177/1048371309331498.
- Battersby, S.L. and Bolton, J. (2013) 'Nonverbal Communication: Implications for the Global Music Classroom', *Music Educators Journal*, 99(4), pp.57-62. doi: <https://doi.org/10.1177/0027432113483143>
- Bauer, W.I. (2014) *Music learning today : digital pedagogy for creating, performing, and responding to music*. New York: Oxford University Press. Available at: <http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199890590.001.0001/acprof-9780199890590> (accessed: 27 January 2023).
- Bearne, E. (2005) 'Interview with Gunther Kress', *Discourse: studies in the cultural politics of education*, 26(3), pp.287-299. doi: 10.1080/01596300500199908.
- Berger, J. (1972) *Ways of Seeing*. Reprint, London: Penguin Books, 1977.
- Berger, R. (2015) 'Now I see it, now I don't: researcher's position and reflexivity in qualitative research', *Qualitative Research*, 15(2), pp.219-234. doi: 10.1177/1468794112468475.
- Berkely, R. (2001) 'Why is teaching composing so challenging? A survey of classroom observation and teachers' opinions', *British Journal of Music Education*, 18(2), pp.119-138. doi: 10.1017/S0265051701000225

- Berry, R. and Wyse, L. (2011) 'The music table revisited: Problems of changing levels of description and abstraction in a tangible representation', in K.L. O'Halloran and B.A. Smith (eds.) *Multimodal studies: Exploring issues and domains*. London: Routledge, pp. 76-94.
- Bezemer, J. (2014) 'How to transcribe multimodal interaction? A case study', in C.D. Maier and S. Norris (eds.) *Texts, Images and Interaction: A Reader in Multimodality*. Online: Mouton de Gruyter, pp. 155-169.
- Bezemer, J. and Jewitt, C. (2010) 'Multimodal Analysis: Key issues'. To be published in *Research Methods in Linguistics*, L. Litosseliti (ed), [Pre-print]. London: Continuum, pp.180-197.
- Bezemer, J. and Kress, G. (2016) *Multimodality, Learning and Communication: A social semiotic frame*. London: Routledge.
- Bezemer, J. and Mavers, D. (2011) 'Multimodal transcription as academic practice: a social semiotic perspective', *International Journal of Social Research Methodology*, 14(3), pp.191-206. doi: 10.1080/13645579.2011.563616.
- Biasutti, M. (2012) 'Group music composing strategies: A case study within a rock band', *British Journal of Music Education*, 29(3), pp. 343-357. doi: 10.1017/S0265051712000289.
- Bilmes, J. (1994) 'Constituting silence: Life in the world of total meaning', *Semiotica*, 98(1-2), pp.73-87. doi: 10.1515/semi.1994.98.1-2.73.
- Birdwhistell, R. (1952) *Introduction to kinesics, an annotation system for analysis of body motion and gesture*. Washington: Department of State, Foreign Service Institute.
- Braithwaite, C.A. (1990) 'Communicative silence: A cross-cultural study of Basso's hypothesis', in D. Carbugh (ed.) *Cultural Communication and Intercultural Contact*. New Jersey: Lawrence Erlbaum Associates Inc., pp.321-327.
- Breeze, N. (2008) *The mediating effects of ICT upon music composition in the classroom*. PhD Thesis. University of Bristol. Available at: <https://ethos.bl.uk/SingleOrder.do?orderNumber=THESIS01140826>. (Accessed: 10 October 2011).
- Breeze, N. (2011) 'Multimodality: an illuminating approach to unravelling the complexities of composing with ICT?', *Music Education Research*, 13(4), pp.389-405. doi: 10.1080/14613808.2011.632083.
- Bremmer, M., Hermans C. and Lamers, V. (2021) 'The charmed dyad: Multimodal music lessons for pupils with severe or multiple disabilities'. *Research Studies in Music Education*, 43(2), pp.259-272. doi: 10.1177/1321103X20974802.

British Educational Research Association [BERA] (2011) *Ethical Guidelines for Educational Research*. London: BERA. Available at: <https://www.bera.ac.uk/publication/ethical-guidelines-for-educational-research-2011>. (Accessed 1 May 2016).

British Educational Research Association [BERA] (2018) *Ethical Guidelines for Educational Research*. 4th edn. London: BERA. Available at: <https://www.bera.ac.uk/publication/ethical-guidelines-for-educational-research-2018>. (Accessed: 15 December 2018).

Bruner, J. (1990) *Acts of meaning*. Cambridge, MA: Harvard University Press.

Burgoon, J.K., Guerrero, L.K. and Floyd, K. (2016) *Nonverbal Communication*. New York: Routledge.

Burn, A. (2017) 'Digital Aletheia: Technology, Culture and the Arts in Education' in A. King, E. Himonides and S.A. Ruthmann (eds.) *The Routledge companion to music, technology, and education*. London: Routledge, pp.3-14.

Burnard, P. (2002) 'Investigating children's meaning making and the emergence of musical interaction in group improvisation', *British Journal of Music Education*, 19(2), pp.157–172. doi: 10.1017/S0265051702000244.

Burnard, P. and Younker, B.A. (2008) 'Investigating children's musical interactions within the activities systems of group composing and arranging: An application of Engeström's Activity Theory', *International Journal of Educational Research*, 47(1), pp.60-74. doi: 10.1016/j.ijer.2007.11.001.

Cain, T. (2004) 'Theory, technology and the music curriculum', *British Journal of Music Education*, 21(2), pp.215-221. doi: 10.1017/S0265051704005650.

Carugno, G. (2018) 'Is Music a Universal Language? From Semiotics to the Recent Findings of Music Psychology', *Interdisciplinary Humanities*, 35(3), pp.26-35.

Chandler, D. (2017) 'Models of the sign' in D. Chandler. *Semiotics: the basics*. 3rd edn. London: Routledge, pp.11-68.

Cohen, L., Manion, L. and Morrison, K. (2018) *Research methods in education*. 8th edn. London: Routledge.

Cooke, C., Evans, K., Philpott, C. and Spruce, G. (2016) *Learning to teach music in the secondary school: a companion to school experience*, 2nd edn. London: Routledge.
Cowan, K. (2014) 'Multimodal transcription of video: examining interaction in Early Years classrooms', *Classroom Discourse*, 5(1), pp.6-21. doi: 10.1080/19463014.2013.859846.

Cowan, K. (2020) 'Tracing the Ephemeral: Mapping Young Children's Running Games', *Designs for Learning*, 12(1), pp.81–93. doi: 10.16993/dfl.90.

- Crescenzi, L., Jewitt, C. and Price, S. (2014) 'The role of touch in preschool children's learning using iPad versus paper interaction', *Australian Journal of Language and Literacy*, 37(2), pp.86-95. doi: 10.1007/BF03651936.
- Creswell, J.H. (2014) *Educational research: planning, conducting, and evaluating quantitative and qualitative research*. 4th edn. Essex: Pearson.
- Creswell, J.H. and Miller, D.L. (2000) 'Determining Validity in Qualitative Inquiry', *Theory into Practice*, 39(3), pp.124-130. doi: 10.1207/s15430421tip3903_2.
- Crotty, M. (1998) *The foundations of social research: meaning and perspective in the research process*. London: SAGE.
- Crown. (1992) Department of Education and Science (1992) *Music in the National Curriculum (England)*. London: Crown.
- Crown. (2015) *Find and compare schools in England*. Available at: <https://www.gov.uk/school-performance-tables>. (Accessed: 13 January 2015).
- Crown. (2022) The power of music to change lives. *A National Plan for Music Education*. Available at: <https://www.gov.uk/government/publications/the-power-of-music-to-change-lives-a-national-plan-for-music-education>. (Accessed: April 2023).
- Dammers, R. (2013) 'Capitalizing on emerging technologies in composition education', in M. Kaschub and J. P. Smith (eds) *Composing our future. Preparing music educators to teach composition*. Oxford: Oxford University Press, pp.201–210.
- Darwin, C. (1872) *The expression of the emotions in man and animals*. Reprint. London: University of Chicago Press, 1965.
- Data Protection Act 1988, c. 29*. Available at: <https://www.legislation.gov.uk/ukpga/1998/29/contents/enacted>. (Accessed: 1 September 2015).
- Dauenhauger, B.P. (1980) *Silence*. Indiana: University Press.
- Davidson, J. and Vanderlinde, R. (2014) 'Researchers and teachers learning together and from each other using video-based multimodal analysis', *British Journal of Educational Technology*, 45(3), pp.451-460. doi: 10.1111/bjet.12141.
- Davidson, J.W. (2012) 'Bodily movement and facial actions in expressive musical performance by solo and duo instrumentalists: Two distinctive case studies', *Psychology of Music*, 40(5), pp.595-633. doi: 10.1177/0305735612449896.
- Denscombe, M. (2014) *The good research guide: for small-scale social research projects*. 5th edn. Maidenhead: Open University Press.

Department for Education (2013) *Music programmes of study: key stage 3 National curriculum in England*. [Online]. London: Crown. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239088/SECONDARY_national_curriculum_-_Music.pdf. (Accessed: 5 September 2013).

Department for Education (2013a) The National Curriculum: Key stage 3 and 4. [Online]. London: Crown. Available at: <https://www.gov.uk/national-curriculum/key-stage-3-and-4>. (Accessed: 5 September 2013).

Department for Education (2021) *Model Music Curriculum: key stages 1 to 3*. [Online]. London: Crown. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974366/Model_Music_Curriculum_Full.pdf. (Accessed: 14 March 2021).

DePaulo, B.M. and Friedman, H.S. (1988) 'Nonverbal Communication', in D.T. Gilbert, S.T. Fiske and G. Lindzey (eds.) *The handbook of social psychology*. New York: McGraw-Hill.

Derry, S.J., Pea, R.D., Barron, B., Engle, R.A., Erickson, F., Goldman, R., Hall, R., Koschmann, T., Lemke, J.L., Sherin, M.G. and Sherin, B.L. (2010) 'Conducting Video Research in the Learning Sciences: Guidance on Selection, Analysis, Technology, and Ethics', *Journal of the Learning Sciences*, 19(1), pp.3-53. doi: 10.1080/10508400903452884.

Devaney, K. (2019) 'Waiting for the wow factor': Perspectives on computer technology in classroom composing', *Journal of Music, Technology and Education*, 12(2), pp.121-139. doi: https://doi.org/10.1386/jmte_00002_1

Devaney, K., Evans, N., Fautley, M. and Ziegenmeyer, A. (2024a) 'Interlude IV Ways to teaching composing', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp. 185-193

Devaney, K., Fautley, M., Grow, J. and Ziegenmeyer, A. (2024) 'Introduction', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp. xx-8

Devaney, K., Ziegenmeyer, A. and Hughes, N. (2024) 'Interlude VII The role of technology in classroom composing', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp. 329-336

Dewey, J. (1902) *The child and the curriculum*. Reprint, Chicago: University of Chicago Press, 2011.

- Dillon, D. R. (1989) 'Showing Them That I Want Them to Learn and That I Care about Who They Are: A Microethnography of the Social Organization of a Secondary Low-Track English-Reading Classroom', *American Educational Research Journal*, 26(2), pp.227-259. doi: 10.3102/00028312026002227
- Dillon, T. (2003) 'Collaborating and creating on music technologies', *International Journal of Educational Research*, 39(8), pp.893-897. doi: 10.1016/j.ijer.2004.11.011.
- Diamantopoulou, S. and Christidou, D. (2019) 'Museum encounters: a choreography of visitors' bodies in interaction', *Museum Management and Curatorship*, 34(4), pp.344-361. doi: 10.1080/09647775.2019.1585279.
- Djonov, E., Tseng, C-I. and Lim, F.V. (2021) 'Children's experiences with a transmedia narrative: Insights for promoting critical multimodal literacy in the digital age', *Discourse, Context and Media*, 43(1), pp.1-12. doi: 10.1016/j.dcm.2021.100493.
- Djonov, E. and van Leeuwen, T. (2018) 'Social media as semiotic technology and social practice: the case of ResearchGate's design and its potential to transform social practice', *Social Semiotics*, 28(5), pp.641-664. doi: 10.1080/10350330.2018.1504715.
- Dobson, E. (2020) 'Talk for collaborative learning in computer-based music production', [Online Lecture] *Multimodal Talk Series*. November 2020.
- Duez, D. (1982) 'Silent and Non-Silent Pauses in Three Speech Types', *Language and Speech*, 25(1), pp.11-28. doi: 10.1177/002383098202500102.
- Duffy, S. and Healey, P.G.T. (2014) 'The conversational organization of musical contributions', *Psychology of Music*, 42(6), pp.888-893. doi: 10.1177/0305735614545501.
- Elliott, D.J. (1995) *Music Matters. A Philosophy of Music Education*. Oxford: Oxford University Press.
- Enfield, N.J. and Sidnell, J. (2017) 'On the concept of action in the study of interaction', *Discourse Studies*, 19(5), pp.515-535. doi: 10.1177/1461445617730235.
- Erickson, F. (2004) *Talk and Social Theory. Ecologies of Speaking and Listening in Everyday Life*. Cambridge: Polity.
- Erickson, F. (2006) 'Definition and analysis of data from videotape: some research procedures and their rationales', in J. Green, G. Camilli and P. Elmore (eds.) *Handbook of complementary methods in education research*. 3rd edn. Mahwah, New Jersey: Lawrence Erlbaum, p.546.
- Erickson, F. (2007) 'Ways of seeing video: Toward a phenomenology of viewing minimally edited footage', in R. Goldman, B. Barron, R. Pea, & S. Derry (eds.) *Video research in the learning sciences*. Mahwah, NJ: Lawrence Erlbaum, pp.145-155.

Eunson, B. (ed) (2012) 'Nonverbal Communication', in *C21: Communicating in the 21st Century*. 4th edn. [Online] Australia: Wiley. Available at: https://www.researchgate.net/publication/341370597_Nonverbal_Communication_1. (Accessed: 28 February 2021).

Fautley, M. (2005) 'A new model of the group composing process of lower secondary school students', *Music Education Research*, 7(1), pp.39–57. doi: 10.1080/14613800500042109.

Fautley, M. (2019) 'The implications of evaluation and educational policy reforms on English secondary school music education', *Arts Education Policy Review*, 120(3), pp.140-148. doi: 10.1080/10632913.2018.1532369.

Fautley, M. (2024) 'Interlude II Creativity and composing in education', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp. 91-101

Fautley, M. and Savage, J. (2008) 'Theoretical approaches to learning and assessment', in M. Fautley and J. Savage (eds.) *Assessment for learning and teaching in secondary schools*. Exeter: Learning Matters Ltd, pp.16-26.

Fautley, M. and Savage, J. (2013) 'Learning', in M. Fautley and J. Savage (eds.) *Lesson planning for effective learning*. Maidenhead: Open University Press, pp.63-71.

Flewitt, R. (2006) 'Using video to investigate preschool classroom interaction: Education research assumptions and methodological practices', *Visual Communication*, 5(1), pp.25-50. doi: 10.1177/1470357206060917.

Flewitt, R., Hampel, R., Hauck, M. and Lancaster, L. (2011) 'What are multimodal data and transcription?', in C. Jewitt (ed.) *The Routledge Handbook of Multimodal Analysis*. London: Routledge, pp.40-53.

Folkestad, G., Lindström, B. and Hargreaves, D.J. (1997) 'Young People's Music in the Digital Age: A study of computer based creative music making', *Research Studies in Music Education*, 9(1), pp.1-13. doi: 10.1177/1321103X9700900101

Fontenot, K.A. (2021) 'Nonverbal communication and social cognition', in *Salem Press Encyclopaedia of Health*. [Online]. Available at: <https://search-ebscohost-com.bathspa.idm.oclc.org/login.aspx?direct=true&AuthType=ip,sso&db=ers&AN=93872125&site=eds-live&scope=site>. (Accessed: 6 February 2021).

Gall, M. and Breeze, N. (2005) 'Music composition lessons: the multimodal affordances of technology', *Educational Review*, 57(4), pp.415-433. doi: 10.1080/00131910500278314.

- Gall, M. and Breeze, N. (2008) 'Music and eJay: An opportunity for creative collaborations in the classroom', *International Journal of Educational Research*, 47(1), pp.27-40. doi: 10.1016/j.ijer.2007.11.008.
- Geenen, J. and Pirini, J. (2019) 'Multimodal (Inter) action Analysis', in J. McKinley and H. Rose (eds.) *The Routledge Handbook of Research Methods in Applied Linguistics*. London: Routledge.
- Gérman, Canale (2021) [Keynote Speaker]. 'Multimodality, ethnography and discourse: negotiating meanings in social interaction', *10th International Conference of Multimodality: 10ICOM*. Valparaíso, Chile [online], 25 August 2021.
- Goodwin, C. (2000) 'Action and Embodiment Within Situated Human Interaction', *Journal of Pragmatics*, 32(10), pp.1489–1522. doi: 10.1016/S0378-2166(99)00096-X.
- Green, L. (2001) *How Popular Musicians Learn: A Way Ahead for Music Education*. Aldershot: Ashgate Publishing Ltd.
- Green, L. (2008) *Music, Informal Learning and the School: A New Classroom Pedagogy*. Aldershot: Ashgate Publishing Ltd.
- Grow, J. and Ziegenmeyer, A. (2024) 'Interlude VIII Why compose in music education?: Arguments between curricular and extracurricular settings', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp. 337-382
- Hall, E. (1959). *The silent language*. New York: Doubleday.
- Hallam, S. (2010). Music education: The role of affect, in P. N. Juslin and J. A. Sloboda (eds.) *Handbook of music and emotion: Theory, research, applications*. Oxford University Press, pp.791–817.
- Halliday, M.A.K. (1978) *Language as social semiotic: the social interpretation of language and meaning*. London: University Park Press.
- Hargreaves, D. and Lamont, A. (2017) *The Psychology of Musical Development*. Cambridge: Cambridge University Press. doi: 10.1017/9781107281868
- Haviland, J.B. (2011) 'Musical Spaces', in J. Streeck, C. Goodwin and C. LeBaron (eds.) *Embodied Interaction: Language and the body in the material world*. New York: Cambridge University Press.
- Heath, C., Hindmarsh, J. and Luff, P. (2010) *Video in qualitative research: analysing social interaction in everyday life*. [Online]. Los Angeles: SAGE. doi: 10.4135/9781526435385

- Heath, C., Luff, P., Sanchez-Svensson, M. and Nicholls, M. (2018) 'Exchanging implements: the micro-materialities of multidisciplinary work in the operating theatre', *Sociology of Health and Illness*, 40(2), pp.297-313. doi: 10.1111/1467-9566.12594.
- Hewitt, A. (2008) 'Children's creative collaboration during a computer-based music task', *International Journal of Educational Research*, 47(1), pp.11-26. doi: 10.1016/j.ijer.2007.11.003.
- Himonides, E. (2012) 'The Misunderstanding of Music-Technology-Education: A Meta Perspective', in G.E McPherson and G. Welch (eds.) *The Oxford Handbook of Music Education*. Volume 2. Oxford: Oxford University Press, pp.433– 456.
- Hodge, R. and Kress, G. (1988) *Social Semiotics*. Cambridge: Polity Press.
- Holmes, A.G.D. (2020) 'Researcher Positionality - A Consideration of Its Influence and Place in Qualitative Research - A New Researcher Guide', *International Journal of Education*, 8(4), pp.1-10. doi: 10.34293/education.v8.4.3232.
- Huovinen, E. and Rautanen, H. (2020) 'Interaction affordances in traditional instruments and tablet computers: A study of children's musical group creativity', *Research Studies in Music Education*, 42(1), pp.94-112. doi: 10.1177/1321103X18809510.
- Iedema, R. (2003) 'Multimodality, resemiotization: Extending the analysis of discourse as multi-semiotic practice', *Visual Communication*, 2(29), pp.29-57. doi: 10.1177/1470357203002001751
- Ingram, J. and Elliott, V. (2014) 'Turn taking and 'wait time' in classroom interactions', *Journal of Pragmatics*, 62, pp.1-12. doi: 10.1016/j.pragma.2013.12.002.
- Jaap, A. (2024) 'The place and value of composition in the music curriculum in Scotland', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp.475-486.
- Jaworski, A. (1993) *The Power of Silence*. London: Sage.
- Jaworski, A. and Sachdev, I. (1998) 'Beliefs about Silence in the Classroom', *Language and Education*, 12(4), pp.273-292. doi: 10.1080/09500789808666754.
- Jaws* (1975) Directed by Steven Spielberg. [DVD, 55193] USA: Universal Pictures.
- Jewitt, C. (2008) 'Chapter 7: Multimodality and Literacy in School Classrooms', *Review of Research in Education*, 32(1), pp.241-267. doi: 10.3102/0091732X07310586.
- Jewitt, C. (2011) 'An introduction to multimodality', in C. Jewitt (ed.) *The Routledge handbook of multimodal analysis*. Abingdon: Routledge, pp.14-27.
- Jewitt, C. (2011a) 'Different approaches to multimodality', in C. Jewitt (ed.) *The Routledge handbook of multimodal analysis*. Abingdon: Routledge, pp.28-39.

Jewitt, C. (2013) 'Multimodal Methods for Researching Digital Technologies', in S. Price, C. Jewitt and B. Brown (eds.) *SAGE Handbook of Digital Technology research*. [Pre-print]. London: Sage.

Jewitt, C. and Franks, A. (2001) 'The Meaning of Action in Learning and Teaching', *British Educational Research Journal*, 27(2), pp.201- 218. doi: 10.1080/01411920120037144.

Jewitt C. and Kress, G. (2003) *Multimodal Literacy*. New York: Peter Lang.

Jewitt, C., Kress, G., Ogborn, J. and Tsatsarelis, C. (2001) 'Exploring learning through visual, actional and linguistic communication: The multimodal environment of a science classroom', *Educational Review*, 53(1), pp.5-18. doi: 10.1080/00131910120033600.

Jewitt, C., Bezemer, J., Jones, K. and Kress, G. (2009) 'Changing English? The impact of technology and policy on a school subject in the 21st century', *English Teaching: Practice and Critique*, 8(3), pp.8-20. Available at: <https://files.eric.ed.gov/fulltext/EJ869391.pdf>. (Accessed: 7 December 2014).

Jewitt, C., Xambo, A. and Price, S. (2015) 'Exploring methodological innovation in the social sciences: the body in digital environments and the arts', *International Journal of Social Research Methodology*, 20(1), pp.105-120. doi: 10.1080/13645579.2015.1129143.

Jewitt, C., Bezemer, J. and O'Halloran, K. (2016) *Introducing Multimodality*. Oxon: Routledge.

Jordan, B. and Henderson, A. (1995) 'Interaction Analysis: Foundations and Practice', *The Journal of the Learning Sciences*, 4(1), pp.39-103. doi: 10.1207/S15327809jls0401_2.

King, A. and Vickers, P. (2007) 'Problem-solving with learning technology in the music studio', *Journal of Music, Technology and Education*, 1 (1), pp.57-67. doi: 10.1386/jmte.1.1.57_1

Kirkman, P.R. (2011) 'Exploring contexts for development: Secondary music students' computer mediated composing', *Journal of Music, Technology and Education*, 3(2-3), pp.107-128. doi: 10.1386/jmte.3.2-3.107_1

Kratus, J. (1989) 'A time Analysis of the Compositional Processes Used by Children Ages 7 to 11', *Journal of Research in Music Education*, 37(1), pp.5–20. doi: 10.2307/3344949.

Kratus, J. (2019) 'Zeitgeist.' Keynote paper presented at Research in Music Education (RiME), Bath Spa University, UK, April 2019.

Kress, G. (1997) *Before writing: rethinking the paths to literacy*. London: Routledge.

- Kress, G. (2010) *Multimodality: A Social Semiotic Approach to Contemporary Communication*. London: Routledge.
- Kress, G. (2011) 'What is mode?', in C. Jewitt (ed.) *The Routledge Handbook of Multimodal Analysis*. Abingdon: Routledge, pp.54-67.
- Kress, G., Jewitt, C., Jones, K., Franks, A. and Hardcastle, J. (2005) *English in Urban Classrooms: A Multimodal Perspective on Teaching and Learning*. London: Routledge Falmer.
- Kress, G. and Selander, S. (2012) 'Multimodal design, learning and cultures of recognition', *The Internet and Higher Education*, 15(4), pp.265–268. doi: 10.1016/j.iheduc.2011.12.003.
- Kress, G. and van Leeuwen, T. (1996) *Reading images: the grammar of visual design*. London: Routledge.
- Kress, G. and van Leeuwen, T. (2001) *Multimodal discourse: the modes and media of contemporary communication*. London: Hodder Education.
- Kress, G., Bezemer, J., Diamantopoulou, S., Jewitt, C. and Mavers, D. (2021) 'A Social Semiotic Perspective on Learning: Transformative engagement in a changing world', in Kress, G., Selander, S., Saljö, R., and Wulf, C. (eds.) *Learning as Social Practice. Beyond Education as an Individual Enterprise*. London: Routledge, pp. 70-102.
- Kruger, A.C. (1992) 'The Effect of Peer and Adult-Child Transactive Discussions on Moral Reasoning', *Merrill-Palmer Quarterly*, 38(2), pp.191-211. Available at: <http://www.jstor.org/stable/23087381> (Accessed: 5 September 2021).
- Kurkul, W. W. (2007) 'Nonverbal communication in one-to-one music performance instruction', *Psychology of Music*, 35(2), pp.327-262. doi: 10.1177/0305735607070385.
- Kurzon, D. (2007) 'Towards a typology of silence,' *Journal of Pragmatics*, 39(10), pp.1673-1688. doi: 10.1016/j.pragma.2007.07.003.
- Lave, J. and Wenger, E. (1991) *Situated learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Lees, H.E. (2012) *Silence in schools*. Stoke-on-Trent: Trentham.
- Lim, V.F. (2019) 'Analysing the teachers' use of gestures in the classroom: A Systemic Functional Multimodal Discourse Analysis approach', *Social Semiotics*, 29(1), pp.83-111. doi: 10.1080/10350330.2017.1412168.
- Lim, F.V., O'Halloran, K.L. and Podlasov, A. (2012) 'Spatial pedagogy: mapping meanings in the use of classroom space', *Cambridge Journal of Education*, 42(2), pp.235-251. doi: 10.1080/0305764X.2012.676629.

Lincoln, Y.S. and Guba, E.G. (1985) *Naturalistic inquiry*. London: SAGE.

Low, D.E. and Pandya, J.Z. (2019) 'Issues of Validity, Subjectivity, and Reflexivity in Multimodal Literacy Research and Analysis', *Journal of Language and Literacy Education*, 15(1), pp.1-22. [Online]. Available at: http://jolle.coe.uga.edu/wp-content/uploads/2019/04/LowPandya_JoLLE2019.pdf. (Accessed: 27 March 2021).

MacRae, C. and Arculus, C. (2020) 'Complicite: Resisting the Tyranny of Talk in Early Childhood', *Global Education Review*, 7(2), 43+. Available at: <https://link.gale.com/apps/doc/A632346443/AONE?u=unisoton&sid=bookmark-AONE&xid=964b337c> (accessed 05 Nov 2023).

MacDonald, R.A.R. and Miell, D. (2000) 'Creativity and Music Education: The Impact of Social Variables', *International Journal of Music Education*, 36(1), pp.58-68. doi: 10.1177/025576140003600107.

Machin, D. (2010) *Analysing popular music: image, sound, text*. London: Sage.

Machin, D. and van Leeuwen, T. (2016) 'Sound, music and gender in mobile games', *Gender and Language*, 10(3), pp.412-432. doi: 10.1558/genl.v10i3.32039.

Marchetti, E. and Jensen, K. (2010) 'A Meta-Study of Musicians' Non-Verbal Interaction', *The International Journal of Technology, Knowledge and Society*, 6(5) pp.1-12. doi: 10.18848/1832-3669/CGP/v06i05/56143.

Maroni, B. (2011) 'Pauses, gaps and wait time in classroom interaction in primary schools', *Journal of Pragmatics*, 43(7), pp.2081-2093. doi: 10.1016/j.pragma.2010.12.006.

Martin, J.L. (2014) 'Semiotic resources of music notation: Towards a multimodal analysis of musical notation in student texts', *Semiotica*, 2014(200), pp.185-201. doi: 10.1515/sem-2014-0006.

Mavers, D. (2009) 'Student text-making as semiotic work', *Journal of Early Childhood Literacy*, 9(2), pp. 141-155. doi: 10.1177/1468798105584.

Maxwell, J.A. (2005) *Qualitative research design: An interactive approach*. 2nd edn. Thousand Oaks, CA: Sage.

McDowall, J. (2009) 'Making Music Multimodally: Young Children Learning with Music Technology', *International Journal of Learning: Annual Review*, 16(10), pp.303-316. doi: 10.18848/1447-9494/CGP/v16i10/46681.

McKerrell, S. and Way, L. (2017) 'Understanding music as multimodal discourse', in L.C.S. Way and S. McKerrell (eds.) *Music as Multimodal Discourse: Semiotics, Power and Protest*. London: Bloomsbury Academic, pp.1-20.

Mehrabian, A. (1981) *Nonverbal Communication*. Reprint, London: Routledge, 2017.

- Mellor, L. (2008) 'Creativity, originality, identity: investigating computer-based composition in the secondary school', *Music Education Research*, 10(4), pp.451-472. doi: 10.1080/14613800802547680.
- Mercer, N. (1995) *The Guided Construction of Knowledge: Talk Among Teachers and Learners*. Clevedon: Multilingual Matters.
- Mercer, N. (2010) 'The analysis of classroom talk: methods and methodologies', *British Journal of Educational Psychology*, 80(1), pp.1-14. doi: 10.1348/000709909X479853.
- Merrick, B. (2016) 'Popular music and technology in the secondary school', in A. King, E. Himonides and A.S. Ruthmann (eds.) *The Routledge companion to music, technology, and education*. Abingdon: Routledge, pp.171-180.
- Mills, J. and Murray, A. (2000) 'Music technology inspected: good teaching in Key Stage 3', *British Journal of Music Education*, 17(2), pp.129-156. doi: 10.1017/S026505170000022X.
- Minott, M.A. (2015) 'Teaching tasks and the composition of a 'piece' using music technology in the classroom: Implications for the education and training of teachers', *Journal of Music, Technology and Education*, 8(3), pp.261-272. doi: 10.1386/jmte.8.3.261_1
- MODE (2012). 'Glossary of multimodal terms', *MODE multimodal methodologies*. [Online]. Available at: <https://multimodalityglossary.wordpress.com/>. (Accessed: 17 March 2014).
- Mondada, L. (2011) 'The organization of concurrent courses of action in surgical demonstrations', in J. Streeck, C. Goodwin and C. LeBaron (eds.) *Embodied Interaction: Language and Body in the Material World*. Cambridge: Cambridge University Press, pp.207-226.
- Mondada, L. (2014) 'The local constitution of multimodal resources for social interaction', *Journal of Pragmatics*, 65(2014), pp.137-156. doi: 10.1016/j.pragma.2014.04.004.
- Mondada, L. (2019) 'Transcribing silent actions: A multimodal approach of sequence organization', *Video-based studies of human sociality Social Interaction*, 2(1), n.p. doi: 10.7146/si.v2i1.113150.
- Moura, H. (2006) 'Analyzing Multimodal Interaction within a Classroom Setting', *Visible Language*, 40(3), pp.270-291. Available at: <https://www.proquest.com/docview/200879244?accountid=8509>. (Accessed: 6 March 2021).
- Mroziak, J. (2017) 'Media', in A. King, E. Himonides and S.A Ruthmann (eds.) *The Routledge companion to music, technology, and education*. London: Routledge, pp.225-234.

- Nijs, L. and Bremmer, M. (2019) 'Embodiment in Early Childhood Music Education', in S. Young and B. Ilari (eds.) *Music in Early Childhood: Multi-disciplinary Perspectives and Inter-disciplinary Exchanges. International Perspectives on Early Childhood Education and Development*. Cham: Springer, pp.87-102.
- Norris, S. (2004) *Analyzing multimodal interaction: a methodological framework*. New York: London: Routledge.
- O'Halloran, K.L. (2007) 'Systemic functional multimodal discourse analysis (SF-MDA) approach to mathematics, grammar and literacy', in A. McCabe, M. O'Donnell and R. Whittaker (eds.) *Advances in language and education*. London: Continuum, pp.75–100.
- O'Halloran, K.L. (2015) 'The language of learning mathematics: A multimodal perspective', *The Journal of Mathematical Behavior*, 40(A), pp.63-74. doi: 10.1016/j.jmathb.2014.09.002.
- O'Halloran, K.L., Tan, S. and Wignell, P. (2016) Intersemiotic Translation as Resemiotisation: A Multimodal Perspective', *Signata*, (7), pp.199-229. doi: 10.4000/signata.1223.
- Ollin, R. (2008) 'Silent pedagogy and rethinking classroom practice: structuring teaching through silence rather than talk', *Cambridge Journal of Education*, 38(2), pp.265-280. doi: 10.1080/03057640802063528.
- Padula, A. (2009) 'Kinesics', in S. W. Littlejohn and K.A. Foss (eds) *Encyclopaedia of Communication Theory*. [Online]. Thousand Oaks, CA: SAGE Publications, Inc., pp.582-84. Available at: https://edge.sagepub.com/system/files%20/77593_4.2ref.pdf. (Accessed 29 June 2012).
- Patton, M.Q. (2015) *Qualitative research & evaluation methods: integrating theory and practice*. 4th edn. Los Angeles: SAGE.
- Peterson, S.S., Rajendram, S. and Eisazadeh, N. (2019) 'Multimodal meaning making during play in two Northern Canadian Indigenous kindergarten classrooms', *Early Years: An International Research Journal*, 39(4), pp.392-407. doi: 10.1080/09575146.2017.1384994.
- Philpott, C. (2016) 'The what, how and where of musical learning and development', in C. Cooke, K. Evans, C. Philpott and G. Spruce (eds) *Learning to teach music in the secondary school: a companion to school experience*. London: Routledge, pp.32-51.
- Philpott, C. and Wright, R. (2019) 'Teaching, Learning, and Curriculum Content', in G.E. McPherson and G.F. Welch (eds.) *The Oxford handbook of music education. Volume I* [electronic resource]. New York: Oxford University Press, pp.441-459. doi: 10.1093/oxfordhb/9780199730810.013.0027_update_001
- Piaget, J. (1961) 'A genetic approach to the psychology of thought', *Journal of Educational Psychology*, 52(6), pp.275-281. doi: 10.1037/h0042963.

- Picard, M. (2002) *The world of silence*. Revised edn. Wichita, Kansas: Eighth Day Press.
- Pink, S. (2013) *Doing Visual Ethnography*. 3rd Edn. London: SAGE.
- Pipe, L. (2015) 'Express yourself: expressive gesture and non-verbal communication skills in popular music performance', *New Vistas*, 1(2), pp.34-39. doi: <https://doi.org//uwl.19>
- Pitt, J. (2023) 'A Posthuman paradigm for early childhood music: Musical play as mycelial embodied polyphony.' Paper presented at Research in Music Education (RiME), Online, UK, April 2023.
- Pitts, A. and Kwami, R.M. (2002) 'Raising students' performance in music composition through the use of information and communications technology (ICT): a survey of secondary schools in England', *British Journal of Music Education*, 19(1), pp.61-71. doi: 10.1017/S0265051702000141.
- Plowman, L. and Stephen, C. (2008) 'The big picture? Video and the representation of interaction', *British Educational Research Journal*, 34(4), pp.541-565. doi: 10.1080/01411920701609422.
- Poulsen, S.V. (2015) 'Multimodal meaning making', *Key Terms in Multimodality: Definitions, Issues, Discussions*, edited by Nina Nørgaard [Online]. Available at: <https://multimodalkeyterms.wordpress.com/>. (Accessed 3 May 2020).
- Poulsen, S.V. and Kvåle, G. (2018) 'Studying social media as semiotic technology: a social semiotic multimodal framework', *Social Semiotics*, 28(5), pp.700-717. doi: 10.1080/10350330.2018.1505689.
- Pramling, N. and Wallerstedt, C. (2009) 'Making musical sense: the multimodal nature of clarifying musical listening', *Music Education Research*, 11, pp.135-151. doi: 10.1080/14613800902924433.
- Price, J. and Savage, J. (2012) *Teaching Secondary Music*. London: SAGE.
- Prokofiev, S. (1936) 'Peter and the Wolf Op. 67'. Available at: <https://www.youtube.com/watch?v=zysITZ3wtIU>. (Accessed: 7 January 2017).
- Ranker, J. (2014) 'The emergence of semiotic resource complexes in the composing processes of young students in a literacy classroom context', *Linguistics and Education*, 25, pp.129– 144. doi: 10.1016/j.linged.2013.10.002.
- Ravelli, L. and van Leeuwen, T. (2018) 'Modality in the digital age', *Visual Communication*, 17(3), pp.277-297. doi: 10.1177/1470357218764436.
- Raymond, G. and Lerner, G.H. (2014) 'A body and its involvements. Adjusting action for dual involvements', in P. Haddington, T. Keisanen, L. Mondada and M. Neville (eds.) *Multiactivity in Social Interaction: Beyond multitasking*. [Online]. John Benjamins Publishing Company. doi: <https://doi.org/10.1075/z.187>

Rogoff, B. (2008) 'Observing sociocultural activity on three planes: participatory appropriation, guided participation and apprenticeship', in P. Murphy, K. Hall and J. Soler (eds.) *Learning and Practice: Agency and Identities*. London: Sage in association with Open University.

Rogue One: A Star Wars Story (2016). [Cinema]. Directed by Gareth Edwards. Pinewood Studios, England: Lucasfilm Ltd. [Viewed 13 December 2016].

Rostvall, A-L. and West, T. (2003) 'A Study of Interaction and Learning in Instrumental Teaching', *International Journal of Research in Music Education*, 40(1), pp.16-27. doi: 10.1177/025576140304000103.

Rostvall, A-L. and West, T. (2005) 'Theoretical and Methodological Perspectives on Designing Video Studies of Interaction', *International Journal of Qualitative Methods*, 4(4), pp.87-108. doi: 10.1177/160940690500400406.

Rowe, M.B. (1974) 'Pausing phenomena: Influence on the quality of instruction', *Journal of Psycholinguistic Research*, 3, pp.203-224. doi: 10.1007/BF01069238.

Sacks, H., Schegloff, E.A. and Jefferson, G. (1974) 'A simplest systematics for the organization of turn-taking for conversation', *Linguistic Society of America*, 50(4), pp.696-735. doi: 10.1353/lan.1974.0010.

Saussure, F.D. and Riedlinger, A. (1974) *Course in general linguistics*. Rev. ed. Edited by C. Bally and A. Sechehaye. London: Fontana.

Savage, J. (2007) 'Reconstructing music education through ICT', *Research in Education*, (78), pp.65-77. Available at: <http://www.jsavage.org.uk/jsorg/wp-content/uploads/2011/03/Reconstructing-music-education.pdf>. (Accessed: 30 October 2010).

Savage, J. (2007) 'Pedagogical strategies for change', in J. Finney and P. Burnard (eds) *Music education with digital technology*. London: Continuum, pp.142-155.

Savage, J. (2010) 'A survey of ICT usage across English secondary schools', *Music Education Research*, 12(1), pp.89-104. doi: 10.1080/14613800903568288

Savage, J. and Challis, M. (2001) 'Dunwich Revisited: collaborative composition and performance with new technologies', *British Journal of Music Education*, 18(2), pp.139-149.

Schmid, S. (2015) 'Children's Multimodal Dimensions of Music Experience: An Open Framework', in O. Krämer and I. Malmberg (eds.) *European perspectives on music education VI: Open ears—Open minds. Listening and understanding music*. Helbling, pp.105 -119.

Scollon, S. and Scollon, S.W. (2011) 'Multimodality and language: a retrospective and prospective view', in C. Jewitt (ed.) *The Routledge handbook of multimodal analysis*. Abingdon: Routledge, pp.170-180.

Scott, S. (2006) 'A constructivist view of music education: perspectives for deep learning', *General Music Today*, 19(2), pp17-21.

Seddon, F.A. (2001) *Adolescent engagement in computer-based composition: analysing the process and product in relation to instrumental experience*. PhD Thesis. University of Keele. Available at: <https://ethos.bl.uk/SingleOrder.do?orderNumber=THESIS01503323> (Accessed: 29 July 2017).

Selander, S. (2008) 'Designs for Learning - A theoretical perspective', *Design for Learning*, 1, pp.10-23. doi: 10.16993/dfl.5.

Shively, J. (2015) 'Constructivism in Music Education', *Arts Education Policy Review*, 116, pp.128-136. doi: 10.1080/10632913.2015.1011815

Silverman, M. (2008) 'Nonverbal Communication, Music Therapy, and Autism: A review of Literature and Case Example', *Journal of Creativity in Mental Health*, 3(1), pp.3-19. doi: 10.1080/15401380801995068

Slekar, T. D. (2005) 'Without 1, Where Would We Begin?: Small Sample Research in Educational Settings. *Journal of Thought*, 40(1), pp.79-86. Available at: <http://www.jstor.org/stable/42589814>. (Accessed 1 January 2020).

Steinberg Media Technologies. (2022) Cubase. [Computer program]. Available at: <https://www.steinberg.net/cubase/>.

Swanwick, K. and Tillman, J. (1986) 'The Sequence of Musical Development: A Study of Children's Composition', *British Journal of Music Education*, 3(3), pp.305-339. doi: 10.1017/S0265051700000814.

TechSmith Corporation. (2016) Camtasia Mac. (Version 3). [Computer program]. Available at: <http://www.techsmith.com>. (Accessed 1 January 2016).

The Apprentice. (2016) BBC One Television, 6 October, 21:00.

'The Snowmen' (2012) *Dr Who*, Series 7. BBC One Television UK. [adapted television clip online].

Tobin, K. (1986) 'Effects of Teacher Wait Time on Discourse Characteristics in Mathematics and Language Art Classes', *American Educational Research Journal*, 23(2) pp.191-200. doi: 10.3102/00028312023002191.

Tomlinson, M.M. (2012) 'Transformative music invention: Interpretive redesign through music dialogue in classroom practices', *Australian Journal of Music Education*, 1, pp.42-56. Available at: <https://files.eric.ed.gov/fulltext/EJ1000244.pdf>. (Accessed: 14 January 2017).

Tomlinson, M.M. (2014) *Transcription Bank: Michelle Margret Tomlinson*. Available at: <https://mode.ioe.ac.uk/2014/06/23/transcription-bank-michelle-margaret-tomlinson/> (Accessed: 17 December 2016).

Unsworth, L. (2001) *Teaching Multiliteracies across the Curriculum: Changing Contexts of Text and Image in Classroom Practice*. Buckingham: Open University Press.

Unsworth, L. (2007) 'Multiliteracies and Multimodal Text Analysis in Classroom Work with Children's Literature', in T.D. Royce and W. Bowcher (eds.) *New directions in the analysis of multimodal discourse*. London: Lawrence Erlbaum Associates Publishers, pp.331-359.

Unsworth, L. and Mills, K.A. (2020) 'English language teaching of attitude and emotion in digital multimodal composition', *Journal of Second Language Writing*, 47, pp.1-17. doi: 10.1016/j.jslw.2020.100712.

van Leeuwen, T. (1999) *Speech, Music, Sound*. Basingstoke: Macmillan.

van Leeuwen, T. (2012) 'The critical analysis of musical discourse', *Critical Discourse Studies*, 9(4), pp. 319–328. doi: <https://doi.org/10.1080/17405904.2012.713204>.

Vidulin, S. (2024) 'The challenges, models, and outcomes of composing in Croatian compulsory schools', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp.76-90

Vygotsky, L.S. (1978) *Mind in Society*. Edited by M. Cole, V. John-Steiner, S. Scribner and E. Souberman. Cambridge, Mass: Harvard University Press.

Wallas, G. (1926) *The Art of Thought*. New York: Harcourt, Brace and Company.

Webster, P.R. (1988) 'New Perspectives on Music Aptitude and Achievement', *Psychomusicology: A Journal of Research in Music Cognition*, 7(2), pp.177-194. doi: 10.1037/h0094169.

Webster, P.R. (2011) 'Construction of Music Learning', in R. Colwell and P.R. Webster (eds.) *MENC Handbook of Research on Music Learning: Volume 1: Strategies*. Oxford: Oxford University Press, pp.35-83. doi: 10.1093/acprof:osobl/9780195386677.003.0002.

Wertsch, J.V. (1991) *Voices of the mind: a sociocultural approach to mediated action*. Reprint, Cambridge, Massachusetts: Harvard University Press, 1993.

West, T. (2011) 'Music and designed sound', in C. Jewitt (ed.) *The Routledge handbook of multimodal analysis*. Abingdon: Routledge, pp.170-180.

Wiggins, J. (2016) 'Teaching Music with a Social Constructivist Vision of Learning', in C.R. Abril and B.M. Gault (eds.) *Teaching General Music: Approaches, Issues, and Viewpoints*. New York: Oxford Academic, pp.49-72.

Williams, J. (1977) 'Star Wars, Original Motion Picture Soundtrack'. Available at: YouTube. (Accessed: 7 January 2017).

Wise, S. (2016) 'Secondary School Teachers' Approaches to Teaching Composition Using Digital Technology', *British Journal of Music Education*, 33(3), pp.283-295. doi: <https://doi.org/10.1017/S0265051716000309>.

Wise, S., Greenwood, J. and Davis, N. (2011) 'Teachers' use of digital technology in secondary music education: illustrations of changing classrooms', *British Journal of Music Education*, 28(2), pp.117-134. doi: 10.1017/S0265051711000039.

Yarbrough, C. (1996) 'The Future of Scholarly Inquiry in Music Education': 1996 Senior Researcher Award Acceptance Address', *Journal of Research in Music Education*, 44(3), pp.190-203. doi: 10.2307/2F3345593.

Yates, L. (2003) 'Interpretive claims and methodological warrant in small-number qualitative, longitudinal research', *International Journal of Social Research Methodology*, 6(3), pp.223-232. doi: 10.1080/1364557032000091824.

Yunker, B.A. and Smith, W.H. (1996) 'Comparing and Modeling Musical Thought Processes of Expert and Novice Composers', *Bulletin of the Council for Research in Music Education*, 128 (Spring, 1996), pp.25-36. Available at: <https://www.jstor.org/stable/40318786> (Accessed: 17 March 2023).

Ziegenmeyer, A. and Devaney, K. (2024) 'Interlude I What is Composing?', in K. Devaney, M. Fautley, J. Grow and A. Ziegenmeyer (eds) *The Routledge Companion to Teaching Music Composition in Schools: International Perspectives*. Oxon: Routledge, pp.49-54

Appendices

Appendix A: Host School's Scheme of Work

YR9 Dr Who	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5	Lesson 6
Title	Introducing Leitmotifs	Exploring harmonic framework	Matching the Action	Developing melodic ideas	Bringing it all together	Reflecting on progress
Objective	All students understand what is meant by the term Leitmotifs, and how to begin to create them	All students understand the importance of working within a harmonic framework for their compositions	All students understand how film music has to work with the visual action in order to be successful	All students understand how to use musical elements to adapt their leitmotifs and compositional ideas to reflect the action	All students understand how to use musical elements to adapt their leitmotifs and compositional ideas to reflect the action	All students understand how to use success criteria to appraise the effectiveness of their work
By the end of the lesson	Students will have listened to a variety of different leitmotifs, and begun to create their own using keyboards/tuned percussion	Students will have completed their leitmotifs, chosen their harmonic area and begun to compose	Students will have identified important action points in the film clip, and begun to compose around their leitmotifs	Students will have used a variety of timbres to compose their soundtrack, including 2 variations minimum of their motifs	Students will have used a variety of timbres to compose their soundtrack, including 2 variations minimum of their motifs	Students will have evaluated the effectiveness of their work using Success criteria

Activities overview	• Using well-known themes, introduce the term leitmotif. • Class discussion recapping on musical elements, and link to themes to establish how these are used to denote character • Watch Peter and the Wolf clip as a historical example of programmatic writing, and encourage students to describe characters themes musically • Introduce the Dr Who film clip and the composition task	• Watch an example of a famous leitmotif being introduced in a film clip (Star Wars or Indiana Jones) • Using discussion recap on the use of musical elements to suggest character • Metacognitive reflection task – ask students to identify the potential pitfalls in the task. Lead discussion to look at the need for a key area • Students adapt their composition ideas from last lesson to reflect their chosen key.	• Watch James Bond clip and ask students to identify how the music reflects the action. Recall Cartoon music from Yr8 also. • Students create movie markers on their track to identify important moments, including when to introduce motifs • Share success criteria sheet to support students to make independent progress. Discuss instrumentation also • Students work on their	• Starter – melodic development. Ask a student volunteer to play a simple motif, then get students to suggest ways to develop n line with dramatic situations • Discuss how students can apply this to their own composition work • Part way through, refer to Success Criteria and ask students to self-assess their work so far	• Starter – play example work from previous year. Ask students to appraise, considering success criteria • Students work on their compositions to complete their soundtracks, with an emphasis on the development of the leitmotifs in the musical context of the action • Students encouraged to use the success criteria to check their work	• Starter – play example of someone receiving bad feedback. Discuss the need to work positively, promoting a Growth Mindset • Explain appraisal task – students will be working in small groups, watching each others soundtracks and discussing their effectiveness • Play outstanding examples to the class as a celebration of high quality work – identifying

	Students begin to compose their own motifs for the 3 characters using keyboards and/or GarageBand as a score function	If time, students set up their project on GarageBand and input their motifs	compositions including creating appropriate atmospheres			different positive features
Assessment options	Formative assessment of use of vocabulary	Formative assessment of leitmotifs, looking at use of standard notation	Formative assessment of vocabulary use and motivation with task	Self assessment using Success Criteria	Self assessment using Success Criteria	Summative assessment – self and peer evaluations
Differentiation	Elements grids from yr8 books	Elements grids from Yr8. Supportive peer groupings	Individual targeted input from teaching staff	Individual targeted input from teaching staff	Individual targeted input from teaching staff	By outcome
Resources	iMacs	iMacs	iMacs Success Criteria sheets	iMacs Success criteria sheets	iMacs Success criteria sheets	iMacs Success criteria sheets

Appendix B: Pupils Assessment Success Criteria

Dr Who Leitmotifs: Success Criteria

Use the questions below to evaluate your progress, and to help challenge yourself further in the composition task. Remember that being able to describe and explain your composition decisions is an important skill when creating original music.

Musical Elements

Timbre:

- How did you choose your timbres? What was the style you had in mind?
- Which of your timbres are appropriate for chords, and which are more suited to melody parts?
- Have you explored the effect of silence? If so, when?

Harmony:

- Do you remain in your key area, or do you use dissonances (clashes) on occasion for effect (e.g. to create a sense of drama)? If so, when?
- Do you use pedal notes (sustained/repeated notes, usually 1st and 5th of your key)? If so, when?

Melody:

- Do you use the notes from your chosen scale or other scales (chromatic, pentatonic) to create bass or melody parts?
- How have you explored different note lengths to create interest and reflect characters? Give an example.

Soundtrack features

- Have you reflected the changes in the **emotions** of the scene (e.g. reassurance to chase to loss)? Give an example referring to the musical elements explored
- How have you considered the changes in camera angles and focus points?
- How have you used your leitmotifs to musically signpost the different characters? Give examples of where you have used them – or if not, why not?
- Have you created a sense of unity by using **fragments** to develop your ideas? Explain how you have done this by describing examples from your composition

Keywords: **Synchronisation** **Characterisation** **Repetition**

Dynamics **Timbre** **Dissonance** **Rhythm**

Doctor Who Leitmotifs

Objective: You are creating the soundtrack for the Snowman Scene

Skills Objective:

- Developing software skills using MIDI keyboards
- Exploring melody, rhythm and timbre to represent characters and narrative action
- Developing your understanding of harmony (key and chords) to create a cohesive composition

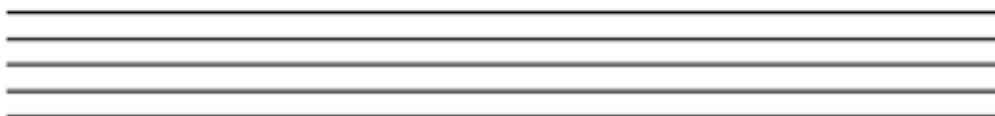
Task 1 – Deciding on the key area

Key: _____

Scale:



Triad



I ii iii IV V

To get you thinking....

- *Are you using major, minor, or modal scales (Aeolian mode on A – Lieutenant Kije)?*
- *If in the minor key, what effect does the raised 7th note have on chord V?*
- *How could you use 7ths to develop your chords further? What effect do they have?*

Task 2 – Creating the motifs

- For each of your characters, consider how their motif – musical signature - might sound – pitch and rhythm in particular
- For each character, follow these steps:

- Write out the rhythm of your motif – keep it short, 8 beats maximum! *Think about note duration and character*
- Remembering your key area, decide which notes you will use
 - Support: use the 1st and 5th note of the scale as a starting point
 - Extension: Think about the scale – you could move away from it to create an interesting effect
- Notate your motif on the following page to create a toolkit of ideas for your composition

Character: _____

Rhythm:

Motif:

Character: _____

Rhythm:

Motif:

Character: _____

Rhythm:

Motif:

Remember – these are just starting points. You will develop and adapt them – changing the octave, timbre and so on – as you compose for the film clip

Task 3 – Starting your Composition

- Download your copy of the Snowman Garageband template.
- Using the project setting, change the key to match your chosen key area
- Watch the movie, and add movie markers (pressing P) where there are key action points
- Start to create your composition!



Hints and Tips:

- *Use your chords to create underlying “pads” – don’t forget some will be major, and others will be minor – good for creating tension!*
- *Changing how you play the chord can have the same effect as changing the chord – experiment!*
- *Chromatic scales can create tension*
- *Silence is very effective!*
- *Develop your ideas as small fragments – repeat, getting higher/lower/quieter/louder – remember Jaws!*
- *Trust your ears.....*

Appendix D: Stage One Lesson Mapping – Lesson One

Lesson 1 Occurrence	Start Time in minutes and seconds	Time Ends	Duration in seconds	Preceding Modal Prompt	Description of Episode
1	01:55	02:06	11	Teacher's verbal instructions: (<i>remember I want to see what scale you're going for</i>) repeated twice S1 movement and speech (<i>we need a bass or something to start off . so basically</i>) S2 action keyboard	Settling down T continuing with verbal instructions
2	02:41	03:01	20	S1 notation S2 speech; gaze and notating on worksheet (<i>key A to A</i>)	Notating the key signature and S1 plays the scale on KB
3	03:22	03:40	18	T verbal response + gesture to S1 question (<i>the triads I'm just putting on the board</i>) S1 (<i>oh okay</i>) + turning movement S2 aural + action	S1 continuation of notation on worksheet + gaze at board. S2 gazes across room then plays KB
4	03:50	04:00	10	S1 verbal instruction to S2 (inaudible) then (<i>never mind</i>) S2 movement towards partner + gesture	S1 continues to notate S2 plays KB
5	04:02	04:14	12	S1 notation + speech (<i>yeah, got it right</i>) S2 action playing KB	S1 continuation of notation on worksheet + movement and gaze at board S2 continuation of KB playing
6	04:15	04:38	23	S1 gaze movement + notation S2 gaze, gesture and movement	S1 continuation of notation on worksheet S2 gaze around room + continuation of KB playing

					T verbal recap of instructions (background)
7	10:07	10:20	13	S1 and S2 joint discussion on Dr Who character with action S1 action keyboard S2 speech (<i>ah yess</i>); aural (sound)	S1 trying out a low pitched melody idea on KB S2 watching and listening to partner
8	10:25	10:35	10	continuing discussion on Dr Who S1 speech (<i>so we have low pitch</i>) + written S2 aural + action	S1 writing or notating ideas S2 trying out low pitched melodies
9	11:58	12:15	17	S1 speech (<i>different methods</i>), movement + action S2 gaze + writing	S1 trying out ideas on KB S2 copying S1's work
10	12:16	12:26	10	S1 action S2 speech (<i>turn it up a bit</i>), movement + action	S1 continuing to try out ideas S2 listening and watching partner
11	12:57	13:11	14	S2 gesture + speech (<i>put your headphones in</i>)	S2 plays a melody idea on the KB to S1 who listens

Appendix E: Stage One Lesson Mapping – Lesson Two

Lesson 2 Occurrence	Time Start in minutes and seconds	Time Ends	Duration in seconds	Preceding Modal Prompt	Description of Episode
1	01:45	02:07	22	Teacher moves away from S1 and S2 S1 moves back in seat towards S2; gesture and verbal instruction (<i>headphones</i>)	S2 moves away from desk to get headphones S1 setting up + searching for movie pointing with mouse
2	02:13	02:23	10	S1 turns towards teacher	S2 returned with headphones setting up + waiting for teacher

				T asks S1 rhetorical question (<i>you don't have the movie do you?</i>) S1 verbal response (<i>no</i>)	
3	03:06	03:24	18	Teacher moves away S2 discussion with S1 about headphones S2 speech/sound (<i>and naaa</i>) episode ends with S2 'turn it up'	listening (S2) pointing with mouse S1 trying out ideas on keyboard
4	03:52	05:15	83	S1 and S2 discussion on where to start mutual agreement through pointing and gesture	watching/listening to movie S1 tentatively trying out ideas
5	05:55	06:19	24	S2 question to S1 (<i>what we doing for the Dr?</i>) S1 speech (<i>TARDIS first</i>) S2 verbal agreement (<i>yeah</i>)	S1 trying out ideas S2 gaze moves from monitor and S1 hands on KB + listening
6	06:26	06:53	27	S2 action playing low pitch notes on keyboard S1 speech (<i>we have to get something don't we?</i>)	S1 searching; pointing with mouse S2 trying out ideas
	07:16	07:25	9		
	07:49				
7	08:09	08:41	32	S2 pointing with mouse + gaze at monitor S1 thinking time + speech (<i>how are we going to . .</i>)	both pupils trying out ideas
8	09:10	09:34	24	natural pause in activity discussion about loops S1 question (<i>what have you actually clicked?</i>) S2 speech and gesture (<i>I don't know, one these buttons</i>)	S1 continues trying out idea S2 sorting out loops (distracted) gesture; pointing with mouse and movement
9	10:50	11:17	27	S1 speech (inaudible) and gesture at monitor S2 action keyboard and mouse	S1 action trying out ideas on keyboard S2 pointing with changing instruments + gaze at monitor

10	11:19	11:43	22	S2 facial expression; head movement directed at S1 + speech (inaudible)	as above
11	11:50	12:03	13	S2 action crashing chord on keyboard S1 speech (<i>shut up</i>) and nudges S2 out of way	continuation: S2 pointing with mouse + facial expression change and S1 action on keyboard
12	12:08	12:23	15	S2 question + verbal suggestion about instrument choice S1 speech + gesture (<i>hang on, try one of these</i>)	continuation: S2 pointing with mouse then action starts to play keyboard S1 action on keyboard
13	12:37	12:57	20	S2 action continuation of playing S1 speech (inaudible . . <i>hang on</i>)	both trying out ideas with instrument sounds
14	16:36	16:48	11	S2 verbal acceptance (<i>ah yeah</i>) + movement	Both action + gaze: trying out melody ideas
15	16:51	17:13	22	S1 verbal instructions (<i>hang on</i>); movement; gesture and pointing of mouse to record	Recording a melody S1 action + gaze S2 gaze and positioning
16	17:36	17:49	13	composition playback S2 verbal instruction (<i>wait, we need ta</i>); gestures + pointing with mouse to pause playback open video	playback with video
17	18:19	18:29	10	no audio on video S2 speech with movement then gesture (<i>actually this is how you do it</i>)	S1 and S2 both exhibit gaze, position and listening but in different ways with playback with video
18	19:05	19:18	13	S2 pointing with mouse S1 speech and gesture (<i>okay, move that back</i>)	S2 pointing with mouse moving tracks; gaze at monitor S1 positioning; gaze and gesture
19	19:25	19:36	11	S1 speech (<i>yeah that's . hang on</i>)	S1 moving tracks S2 pointing with mouse, position and gaze

20	19:54	20:05	11	continuation with above problem resolution with S1 speech (<i>there we go</i>)	resolution (S1) S2 action playing keyboard then position and gaze change S1 pointing with mouse then action playing melody
21	20:21	20:31	10	verbal disagreement between S2 (<i>it is</i>); S1 (<i>it's not</i>) and S2 (look) change of instrument	testing sound S2 action playing keyboard S1 pointing with mouse
22	20:34	20:54	20	S1 (okay, try again) + movement to record	recording (then trying to edit track length) S2 position and gaze S1 action recording melody using keyboard
23	21:02	21:13	11	S1 speech (<i>I think</i> [inaudible])	Both: position; gaze and listening to playback with S2 turning movement and requesting teacher support
24	22:13	22:47	34	discussion about track. S2 question to S1 (<i>Clara what?</i>) S1 responds (<i>french horn</i>)	S1 and S2 action trying out ideas on keyboard gaze different then both move and reposition self to comply with teacher's instructions + verbal input
25	26:01	26:12	11	S1 instructions to S2 (<i>create this one, okay right hang on</i>) adding new track	S2 gaze and pointing S1 action playing known tune
26	26:19	26:29	10	S2 verbal suggestion (<i>what about saxophone?</i>)	S1 action trying out ideas to saxophone sound, gaze S2 gesture, facial expression and action

27	26:57	27:12	15	S1 speech, movement and gesture (so. . [click, click, click] <i>hang on</i>)	S1 action recording melody on keyboard, gaze and listening S2 gaze, position and listening
28	27:41	27:58	17	discussion on playback outcome S2 speech (<i>I'll record it</i>) S1 speech response (<i>em</i>)	S2 pointing mouse then re-position and gaze S1 action playing keyboard re-recording
29	28:06	28:17	11	listening to playback S1 verbal suggestion (<i>let's just listen</i>) + movement both pupils	Both: sound, positioning and gaze different whilst reviewing recorded section
30	28:57	30:11	14	adding new track + selecting instrument S1 speech (<i>right, hang on</i>)	S1 action + gaze trying out chords S2 pointing with mouse + gaze finding instrument until S1 takes over S2 action keyboard
31	30:27	30:42	15	verbal identification of character motif S2 speech (<i>that could be the Dr's</i>) S1 responds, gesture and movement (<i>hang on, let's record. It's definitely the Ice Maiden</i>)	recording S1 action, gaze and gesture S2 position, gaze and facial expression
32	30:43	30:56	13	S1 speech and gaze (<i>okay</i>) mouse movement searching for something	S1 and S2 position, gaze and listening different for the playback of recorded track
33	31:33	31:45	12	mouse movement; S1 speech (<i>if we mute . . just checking</i>) muting tracks; action headphones	playback and reviewing Dr Who track S2 position and gaze changes S1 position, gaze and listening
34	32:39	32:54	15	S1 speech (inaudible) and mouse pointing S2 responds with sigh	S1 action editing Clara track using mouse S2 position, gaze and movement

35	32:57	33:21	24	S2 comments (inaudible)	playback - listening, gaze and position editing - mouse pointing and movement
36	33:59	34:20	21	S1 speech (<i>hang on</i>) seemingly directed at S2 although S1 gaze at monitor placement of a copied track (<i>Clara</i>)	reviewing and editing
	34:33	35:33		34:36 T input;34:44 pause music (1min)	
37	35:52	36:02	10	Teacher input and moves away S1 laughs S2 question (<i>what time are we at already?</i>)	Both pupils notating on worksheet facial expressions change as does position and gaze
38	37:30	37:44	14	S2 singing Mary has a little lamb tune using 'do do'	notation continued as above
39	38:27	38:37	10	S2 asking inaudible question to S1 ended with (<i>how?</i>)	Teacher mentions treble clefs loudly which S1 reacts to - movement notation continued
40 S1 only					
41	41:21	41:33	12	S2 whistling S1 action - puts headphones on and gesture	S1 action trying out idea on keyboard
42	41:51	42:22	31	S2 question (<i>can we listen to it when the music comes in?</i>) S1 responds (<i>alright</i>) + gesture	S2 pointing enlarges video reviewing gaze, listening and position
	42:23		675 seconds	Lesson ends	

Appendix F: Stage One Lesson Mapping – Lesson Three

Lesson 3 Occurrence	Time Start in minutes and seconds	Time Ends	Duration in seconds	Preceding Modal Prompt	Description of Episode
1	00:16	00:48	32	S1 verbal instruction (<i>headphones</i>) S2 question (<i>Is there a splitter at the end?</i>)	setting up
2	00:50	01:16	26	Teacher loud verbal input S2 speech (inaudible)	searching and thinking time/listening S2 head turn and movement
3	02:49	03:24	35	S1 instructions (<i>add another track</i>) and gesture + movement away S2 responds - pointing mouse + gaze	S2 setting up new backing track, pointing with mouse, gesture and gaze then listening S1 returns with headphones
4	04:23	04:34	11	S1 thinking time, gesture and gaze S1 question (<i>what's that?</i>), gesture and gaze S2 pointing with mouse + response to S1 (inaudible)	S2 listening and gaze at ice maiden track S1 gaze, no headphones on
5	04:49	05:10	21	S2 mouse movement + action qwerty S1 head turn and gaze + speech (<i>how we gonna do this?</i>) then action headphones	S1 trying out chords S2 position, gaze and listening - ends with S2 asking (<i>what are you doing?</i>)
6	06:05	06:20	15	S1 gaze and action S2 (<i>Is that . . .</i> inaudible) and gaze	Both pupils action trying out ideas on keyboard + gaze and gesture
7	06:32	06:42	10	S1 speech discussing musical elements S2 action keyboard + gaze	Thinking time for S1 the action keyboard - chords S2 action keyboard - melody

8	06:42	07:00	18	Continuation after S2 sighs	S1 gesture and gaze then action keyboard S2 action playing melody on keyboard. Movement, gaze and position S2
9	07:13	07:26	13	S2 verbal suggestion (<i>try one melody at a time, like [action] one chord or something</i>) S1 action playing keyboard and gaze	Both pupils trying ideas but individually S2 action play familiar tune on keyboard
10	07:29	07:55	26	S2 comment (<i>it's quite hard isn't it?</i>) + action keyboard S1 action playing keyboard and gaze	Both action + gaze but individually trying ideas - S1 chords and S2 melody
11	07:58	08:19	21	S2 speech and directed gaze (<i>wrong note</i>) S1 brief (inaudible) response S2 action still playing KB S1 thinking	S1 action qwerty, gaze gesture and positioning S2 alternates between action keyboard and listening [sound] and gaze
12	08:39	08:49	10	S1 pointing mouse searching program gesture, gaze then speech (inaudible) S2 position, gaze and gesture	S1 pointing mouse actioning changes to composition S2 gaze and position
13	08:52	09:05	13	S1 speech (inaudible) + action qwerty	Both pupils gaze, positioning and listening
14	09:20	09:58	38	S2 speech (<i>wait wait</i>) and action stops playback continuation from Ep 12	S2 pointing with mouse both gaze, gesture, positioning and listening to tracks S1 pointing with mouse
15	10:05	11:15	10	S2 instruction (<i>maybe shorten that</i>) gesture + gaze S1 mouse pointing + gaze	S1 editing using mouse + gaze and position S2 gaze, position and gesture

					Stopped by teacher loud verbal instruction
16	14:43	15:03	20	Teacher's instructions (<i>carry on, use your motifs . . start with simple ideas</i>) S2 asked researcher question S1 action mouse searching	S1 mouse searching for instrument + gaze S2 movement, gaze and gesture then action playing keyboard
17	15:06	15:21	15	S1 speech (no, just no) + gesture S2 facial expression Continuation from Ep 14	S1 mouse finding right sounding instrument. Then action trying out chords using keyboard S2 action playing keyboard, gaze and positioning
18	15:25	15:49	24	S1 sound produced by action keyboard S2 verbal acceptance (<i>That sound really evil</i>), gaze, facial expression and position	Recording, playback and reviewing
19	16:04	16:16	12	S2 verbal instruction (<i>bring that all the way down</i>)	Playback, reviewing and editing Both pupils gaze, positioning, gesture S1 mouse pointing S2 action qwerty
20	16:33	16:46	13	S2 verbal instruction (<i>yeah, that one higher</i>) S1 response mouse pointing and speech (<i>yeah</i>)	S1 action, mouse - editing. gaze and gesture S2 positioning, gaze and listening reviewing
21	17:02	17:19	17	S1 speech (<i>hang on, I know what to do</i>)	Editing and reviewing S2 position and gaze S1 mouse pointing, gaze and position

22	17:45	18:37	52	S1 and S2 discussion on track linking (expanding composition) S2 verbal agreement + gesture	S1 action trying out chords; records and playback with edits S2 gaze and position
23	18:39	18:51	12	S2 verbal acceptance (<i>yeah, that works well</i>)	Reviewing Both pupils gaze and position
24	19:10	19:22	12	S2 gesture at the monitor, gaze and speech (<i>we could have that at the end as well</i>) S1 verbal agreement	Adding movie markers S2 gaze and position S1 mouse pointing and gaze
25	19:48	20:01	13	S2 pointing with mouse muting musical tracks + speech (<i>whoa, whoa, wait</i>)	Finding movie markers S1 gaze and position S2 mouse pointing, gaze and positioning
26	20:45	21:00	15	S2 speech (hang on mute that) S1 speech (yeah) Listening to edits, gesture, gaze and positioning	Reviewing edits and movie markers S1 gaze, gesture and position S1 mouse pointing, gaze and position
27	21:48	22:01	13	S1 and S2 verbal agreement in resolving and adjusting dynamics and movie markers (editing) S1 gesture and speech	Reviewing S1 action - qwerty, gaze, gesture and position S2 gaze and positioning
28	22:28	22:40	12	Adult interruption	Packing away

Appendix G: Stage One Lesson Mapping – Lesson Four

Lesson 4 Episode	Time Start in minutes and seconds	Time Ends	Duration in seconds	Preceding Modal Prompt	Description of non-verbal communication
1	04:40	04:52	12	Teacher's verbal instructions to find and open moodle on computer	S2 pointing with mouse gaze at monitor S1 movement and gaze
Move away from computer (00:53 – 04:47 = 3mins 53 secs)					
2	06:49	07:00	11	Teacher calling the register	S1 pointing with mouse opening up composition + gaze S2 movement, gaze and gesture towards another pupil
3	07:06	07:18	12	S1 gaze, sound and action keyboard	S1 listening and recapping composition S2 mucking around action and gesture
4	07:24	07:36	12	S1 speech (can you? wait, hang on) and movement getting HP's S2 gaze and position	S1 movement away from computer S2 gaze at monitor; action tapping keyboard then pointing with mouse
5	07:55	08:24	29	S2 waiting; action keyboard S1 action plugging in headphones and action headphones putting on and qwerty	S2 gaze and position S1 gaze and pointing with mouse Both listening to composition

6	08:54	10:05	71	S1 pointing with mouse and speech (<i>no that's not right</i>)	S1 pointing with mouse, gaze, position and gesture S2 gaze, gesture and movement Editing and listening
7	10:44	10:58	14	S2 gaze at monitor S1 pointing with mouse, gaze and speech (<i>hang on, I'm just gonna</i>)	S1 pointing with mouse and gaze S2 gaze Editing continues
8	11:03	11:18	14	S2 gaze S1 gaze, pointing with mouse , movement and speech (<i>what are they playing there?</i>)	S1 pointing with mouse, gaze and action qwerty S2 direction of gazes Editing but copying of a track
9	12:10	12:36	26	S2 verbal suggestions , gaze and gestures S1 pointing with mouse, gaze discussing amendments	S1 action qwerty, gaze and pointing with mouse S2 gaze and position Editing but copying of a track
10	12:45	13:04	19	S1 speech (<i>You're being recorded</i>), gaze and action qwerty and mouse S2 response (<i>oh yeah</i>)	Checking edits (listening, positioning and gaze)
11	13:23	13:39	16	S1 speech (<i>let's find out when they speak</i>), gaze and mouse pointing S2 verbal suggestion (<i>look, it's when those two inaudible</i>), gaze and gesture	S2 movement, gaze S1 gaze then pointing with mouse Sound: listening to find beginning of S2's suggestion
12	14:06	14:30	24	S2 verbal suggestion , gaze and gesture S1 mouse, gaze and speech (<i>oo, what's happened there?</i>)	S2 gaze and listening, head movement S1 gaze, gesture and listening. some mouse pointing
13	14:41	15:06	25	S2 verbal comment (inaudible), gaze, gesture and movement	Adding edits and playback S1 mouse pointing, gaze,

				S1 verbal comment (inaudible), gesture, gaze and mouse pointing	S2 direction of gaze, action, facial expression
15:06 – 16:00 removed due to ethical reasons (54secs)					
14	16:00	16:48	48	Sound; both pupils gaze at monitor S1 mouse movement S2 action headphones	Playback - checking edits (dynamics) S1 mouse pointing, gaze, action qwerty, movement S2 gaze, gesture and movement
15	17:04	18:00	56	Continuation from Ep13	Editing and reviewing S2 action qwerty, gaze, movement and gestures S1 mouse pointing, gaze, qwerty and gestures
18:06 - 21:47 Teacher increase speech volume instruction (<i>okay guys can you . . .</i>) whole class input (3mins 41 secs)					
16	21:47	22:12	25	S2 speech (<i>oh my god I'm so tired</i>), movement S1 gaze, mouse pointing Continuation from before T input.	Listening/watching and editing Ice Maiden track S1 gaze, gestures, position and mouse - action qwerty S2 positioning, gaze
17	22:36	23:49	73	S2 action keyboard playing, gaze and speech (inaudible) S1 movement, mouse and gaze Focusing on smaller part (when Clara falls from Tardis)	S1 gaze, gesture and mouse pointing- finding new instrument by replaying and editing. Then action playing chords on keyboard S2 action playing keyboard, gaze both facial expressions change during episode

18	23:52	24:02	10	S2 verbal suggestion (inaudible), gaze, gesture and movement Sound	S1 gaze and mouse pointing S2 gaze, gesture and movement Searching for movie marker and instrument
19	24:05	25:31	86	S2 speech (inaudible) and gaze S1 gaze and mouse movement	Reviewing, S1 movement, gaze and mouse S2 gaze and position Later S1 and S2 action keyboard S2 direct gaze into camera Partial mucking around but also action playing keyboard - trying out sounds laughter and gaze between S1 and S2
20	25:34	25:47	13	S2 action playing keyboard , gaze and speech (<i>do that thing again like this</i>) S1 action keyboard and gaze	both action playing keyboard and gaze- trying out ideas S2 repositions himself
21	25:49	26:22	33	S2 speech, gaze and action (<i>do that thing you were doing before</i>) S1 action qwerty	Playback and editing S2 action playing keyboard, gaze S1 action qwerty, mouse and gaze
22	26:23	26:34	11	S1 direction of gaze, gesture, movement , and speech (<i>hang on</i>)	S1 movement to stop S2 playing keyboard, gaze, movement and mouse pointing S2 movement, gaze, gesture and facial expression listening both

23	27:07	27:18	11	S1 speech, gaze, facial expression and gesture (<i>okay, ah oh well</i>) S2 action qwerty , gaze and facial expression	Playback of changes S2 movement, gaze and facial expression S1 gaze, gestures and facial expression
24	27:34	28:15	38	S2 action keyboard and gaze S1 action headphones , gaze and mouse	Playback of changes S2 gaze and position then action box, gaze resolving the ending of the composition S1 gaze, position and gesture; action qwerty and mouse then keyboard S1 and S2 moment of quiet laughter
25	29:52	30:11	19	discussion between S1 and S2 on edits S1 question (<i>is that right?</i>) action headphones + gesture towards mouse S2 speech (<i>no</i>) + action qwerty	S2 action qwerty , movement and gaze S1 gaze, gesture and mouse Reviewing from beginning (stopped at bar 9)
26	30:44	32:09	25	S2 speech (inaudible) , gaze, action mouse and gesture S1 gesture and gaze	Both watching the video clip whilst listening to the composition: gaze, gesture and positioning. S2 mouse
27	33:00	33:24	24	S2 action keyboard, mouse, gaze and speech (<i>from here</i>) S1 gaze and speech (we're going to watch from here) + action qwerty	Reviewing video clip with focus on ending of composition

					S1 movement, gaze, gesture and mouse S2 position and gaze
28	33:58	34:28	30	S1 mouse movement, gaze S2 speech whining noise + movement and gesture	Editing and reviewing end section S1 action mouse + qwerty; gaze; audio S2 facial expression, gesture, gaze movement
29	35:15	35:30	15	S2 speech (<i>I might actually fall asleep in a moment</i>) and gaze S1 mouse movement and gaze	S1 searching for instrument/trying out idea mouse; gaze and action keyboard S2 positioning and gaze
30	35:42	35:55	13	S2 movement, gesture, gaze and action keyboard S1 speech (<i>hang on</i>) and action keyboard	S1 trying out idea (pop goes the weasel) action keyboard, gaze S2 facial expression, gaze, gesture then action keyboard
31	36:20	36:41	21	S2 action keyboard and gaze S1 mouse pointing, action headphones, gaze	S1 action keyboard, gaze - trying out different percussion sounds S2 gaze, facial expression and gesture
32	37:09	37:32	23	S1 action keyboard with gesture and laughter S2 positioning, action, gaze and speech (<i>ow</i>)	Finding the right sound S1 action keyboard, mouse pointing, gaze and movement S2 positioning and movement, gaze and action
33	37:35	37:58	23	S1 speech (<i>got it</i>) and action keyboard and mouse S2 speech (inaudible) and positioning	Practising pop goes the weasel S1 action keyboard, gaze and gesture

					S2 positioning, gaze and action
34	39:01	39:12	11	Finish replay of known tune S2 speech (<i>that's gonna</i> inaudible) , gesture, gaze and action keyboard S1 mouse pointing , gesture and gaze	Editing S2 action keyboard, gaze and movement S1 mouse, gaze, action headphones
35	39:38	39:50	12	S2 action keyboard; gaze and question (<i>like that?</i>)	S2 action keyboard, gaze S1 action headphones and keyboard - playing known tune
36	39:52	40:04	12	S2 speech (<i>that sounds like an Adele song</i>) , gesture and gaze recognition of song S1 action keyboard, gaze	S1 action keyboard, gaze - continues playing song S2 positioning and gaze
37	40:48	41:38	50	S1 mouse movement on piano roll , speech (<i>that is the recording</i>) and gaze	Editing S1 mouse pointing, gaze and movement. Action keyboard playing arpeggios S2 positioning and gaze
38	41:43	42:04	21	S2 speech (<i>I'm so tired</i> . . inaudible) S1 continuation Ep36: mouse movement manipulating note lengths on score function	S1 mouse pointing, gaze - editing arpeggio note lengths on piano roll S2 positioning, gesture and gaze
39	42:06	44:21	135	S2 question (<i>what are you doing here?</i>) S1 continuation from Ep36	Editing and reviewing S1 mouse pointing, gaze - editing arpeggio note lengths on piano roll. action qwerty and gaze S2 positioning, gesture and gaze. action keyboard and movement

40	44:31	45:05	34	S2 speech (inaudible + yawn) S1 gesture, mouse pointing and gaze	Reviewing end section S1 mouse pointing, gaze and gesture S2 positioning and gaze
41	45:34	46:26	52	T approached pupils + speech (<i>Can I listen?</i>) S1 and S2 respond, talk and laugh	T listening S1 and S2 positioning and gaze
42	46:29	46:48	19	S2 talking to S1 (inaudible) then both laugh continuation from Ep40 S1 and S2 positioning; gaze and sound	T listening S1 and S2 positioning and gaze. S2 gesture and facial expressions
46:48 - 48:27 Teacher's verbal feedback (99 seconds: 1 min 39 seconds) Finding suitable instrument for chords/ reviewing and editing dynamics/ remove Pop goes the weasel					
43	48:51	49:28	37	S2 gaze, movement and mouse movement S1 gaze and speech (inaudible)	S1 action qwerty; sound and gaze. Mouse movement S2 action keyboard cluster of notes; gaze and movement
44	49:37	50:10	33	S2 speech (<i>this is the day</i>) S1 gaze and mouse movement sound	Editing and reviewing S2 facial expression, positioning and gaze S1 mouse pointing and gaze
45	50:59	51:43	44	S1 and S2 discussion S1 question (<i>Why isn't this playing?</i>), gaze and mouse pointing + gesture	Editing and reviewing S2 facial expression, positioning and gaze S1 mouse pointing and gaze
46	51:56	52:19	23	S1 action keyboard and gaze S2 speech (<i>inaudible, play that</i>)	S1 action keyboard - playing known tune and gaze S2 gesture, positioning and gaze
47	53:15	53:33	18	S2 dialogue with Researcher	recording S2 gaze, movement

				S1 action headphones, action qwerty and mouse pointing	S1 gaze, mouse pointing and action keyboard
48	54:54	55:59	65	S2 question (<i>where the teachers at?</i>), movement and gaze S1 speech (<i>I'll turn the volume down</i>), gesture and gaze both action headphones	Review of composition (with mucking around - gestures over qwerty) S1 action qwerty, gaze, gesture and facial expression S2 gaze, gesture, movement and facial expression
55:56 - 57:53 Teacher verbal instructions (<i>cmd s; turn around and we'll review where we're at</i>) Whole class input + instructions to look at Moodle. (117 seconds: 1 minute and 57 seconds)					
49	58:14	58:24	10	S1 mouse movement; gaze + speech (<i>hold on</i>) S2 positioning and gaze	S1 continued mouse movement and gaze S2 positioning and action clapping hands and clicking fingers (gesture)
50	59:50	1:00:01	10	S2 question to S1 with gesture; S1 speech (<i>I'm starving</i>) and action qwerty	Both pupils action headphones - sound S2 action keyboard then qwerty S1 mouse movement
51	1:00:32	1:00:50	17	S1 and S2 action keyboard	S2 action keyboard; gaze; movement and gesture S1 action keyboard and gaze
1:01:05 Teacher increase volume + verbal instructions to start packing away.					

Publications

Published:

Byrne, J. (2016) *Sempre MET2016: Researching Music, Education and Technology*. London, March 2016. London: Sempre.

https://www.researchgate.net/publication/316890620_Exploring_the_silences_in_Secondary_School_music_technology_lessons_methodological_challenges

Exploring the silences in Secondary School music technology lessons: methodological challenges

Paper submission.

Julie Byrne

Bath Spa University

UK

Abstract

Within the context of a Secondary School music classroom, there is evidence that advancements in music technology continue to facilitate pupils' composing processes. While technology provides immediate and ongoing accessibility for pupils' work in progress, its usefulness in providing insights to pupils' experiences of modes used in the process of composition – visual, speech, sound, music and gestures – is limited. This becomes more problematic when communication between collaborating composers occurs in silence. The aim of my research was to explore Year 9 pupils' multimodal processes while they collaborated on compositional tasks using music technology. A multi-method case study approach was designed, with data drawn from online diaries, focus groups and informal interviews. Audio recordings and field notes from two lesson observations provided further information. Eliciting pupils' experiences and opinions of multimodal processes in collaborative composition and then interpreting meanings attributed to their experiences poses several

methodological challenges for the researcher. These will be outlined in the presentation. Initial findings indicate that, with the exception of the diary entries, pinpointing multimodality in music technology is a complex process. Accuracy in depicting pupils' collaborative learning by using different music technology modes has led to exploration in how multimodal transcripts can best support the construction of pupil narratives.

Keywords: multimodal processes, music technology, collaborative composition

[the published conference paper on pp 440-441 has been removed from the digital version of the thesis for copyright reasons]

Learning narratives pave way to modify computer compositional strategies.

Julie Byrne

Bath Spa University, UK

Abstract

A 21st century secondary school music classroom incorporates music and computer technology where composing in Key Stage Three (ages 11-14) now predominantly use this technology. However, compositional strategies tend to remain embedded in traditional compositional values and often exclude pupils' perspectives. I will present initial findings from my doctoral research and focus on the learning narratives of the participants offering an unseen perspective to their encountered and collaborative compositional stages. Four sequential lessons were observed where field notes and Camtasia video footage captured the pupils' collaborative work. Each lessons data was reviewed and silent compositional interactions were selected as integral to eliciting pupils' perspectives during four interviews. Pupils' interview responses provided transcripts for thematic and multimodal interactional analysis. Framing analysis from a musical and multimodal stance places pupils' learning narratives at the forefront to 'what really goes on in music lessons' where much of their learning occurs in silence and is invisible to the teacher. Results indicate there is potential to explore an alternate theoretical or learning model to computer composition that considers pupils' experiences and a further necessity to re-examine teaching strategies. These will be outlined in the presentation.

Keywords

computer compositional strategies, multimodal, learning narratives

Aims

Drawing on literature that directly references music technology and composition Folkestad, Lindstrom and Hargreaves (1998); Mellor (2008) and Savage (2005) provide useful learning models for how music technology and composition can be perceived in a music classroom setting. Simply put they discuss, '...compositional strategies, not to structures in music itself'

(Folkestad et al., 1998, p83). It is these compositional strategies that this paper and my presentation will focus on by exploring how the pupils' learning narratives of computer composition, in the secondary school music classroom, offer an unseen perspective to their encountered and collaborative compositional stages. To briefly outline these three compositional strategies, Mellor (2008, p458) looked at the process of computer composition and suggested composing consists of five thematic interactions which are: construction, replay, editing, mouse movement or inactivity for more than 4 seconds and errors using the program. Whereas a complementary model offered by Folkestad, Lindstrom and Hargreaves (1998) provided a visual insight to individuals' compositional preferences highlighting findings from their on-screen interactions. That is, how an individual uses the visual mode of the computer program to compose horizontally or vertically. Savage (2005) conceptualised towards a three-staged learning model comprising of selection, structure and evaluation. In a music classroom much of the computer compositional learning occurs in silence and this learning is often invisible to the teacher. I am suggesting that by foregrounding learning narratives, generated from the participants' experiences, will add to any current computer compositional models as research seeks to explore and reveal those silent compositional interactions.

Methods

Camtasia™ —a computer screen capture program— was used to capture and record two pupils' conversations, music and their computer work of four sequential music lessons. Eye gazes, facial expressions and upper body movements were captured using the internal camera on the schools computer and an additional smaller camera offered a different visual perspective and videoed pupils' interactions with the computer, musical equipment and each other. Researcher lesson observation notes were made which identified potential silent episodes to further explore. Directly after the observation the Camtasia data was extracted from the schools system to a secured external hard drive. Both sources of video data were merged to provide one continuous video document of each lesson. From this a reviewing process commenced where up to three silent episodes (each a minimum of 10 seconds long with no upper limit) were selected and used in the individual interviews to explore decisions behind their compositional stages and multimodal processes. Four informal one-to-one inter-

views occurred post observation where the participants were invited to discuss their music work and asked to recollect their experiences. There was minimal interview question preparation as the chosen silent episodes, on Camtasia, were the primary focus for discussion. These were reviewed individually. Questions were based on their responses and comments to what happened in the lesson and to what they viewed. Audio recordings of these conversations were transcribed for purposes of thematic and multimodal interactional analysis.

Outcome(s)

Results reported will refer to the Camtasia footage of silent episodes, transcripts of pupils' interview responses and field notes. Thematic analysis generated five main musical themes which were - rudiments, composition stage, reasoning, musical understanding and confusion. The learning narratives detail the participants' individual and collaborative experiences of computer composition. The task was shaped through traditional composition methods (Swanwick and Tillman, 1986) and findings from my doctoral research recognised the pupils' computer composing experiences included: notating scales, rhythms and leitmotifs onto manuscript paper. Composition involved and assumed a particular knowledge and understanding of cultural language associated with the pupils' prior learning. Despite working collaboratively, the pupils' experience and understanding of whole task and sequence to various compositional stages differed. This goes beyond the function of 'each pupil having their own role' and perhaps signifies the limitations in how the technical and musical vocabulary could support their learning. What the latter has provided is an in-depth gateway to mapping these different compositional stages.

Discussion

Mellor (2008) and Folkestad et al., (1998) compositional models are generated from the visual or on-screen monitor as a means to categorise the individuals' processes of computer composition. They restrict their attention to one mode and a limited element of that mode. The visual mode outlined here does not incorporate the use of icons, colours, words, pictures or symbols that embodies the multimodal framework as described by Kress and van Leeuwen (2001). Savages' (2005) three-staged learning model focused on musical processes within composition, namely creation and manipulation of sound. The model shares similarities to the four

stages of creativity: preparation, incubation, illumination and verification although this is not my focus here. Kress and van Leeuwen (2001) however, would dismiss the idea of observing modes in isolation from others as effective communication requires more than one mode i.e. sound and action. Foregrounding a single mode is not consistent with the assumptions of multimodality although presenting interaction and meaning-making between two modes is acceptable. These models alone are insufficient in verifying pupils' multimodal or compositional learning experiences in the music classroom. Thereby, exploring alternative compositional strategies based on pupils' narratives seeks to provide a learning model that links composition with their multimodal interactions – making the invisible, visible.

Acknowledgements

I would like to acknowledge and thank my supervisors - Dr. Kendra McMahon and Dr. Mary Stakelum - for their support with my doctoral research and this submission.

References

1. Folkestad, G., Hargreaves, D.J. and Lindström, B. (1998). Compositional Strategies in Computer-Based Music-Making. *British Journal of Music Education*, 15(1), 83. Retrieved from: DOI: 10.1017/S0265051700003788
2. Kress, G., & Leeuwen, T. v. (2001). *Multimodal discourse: The modes and media of contemporary communication* London: Hodder Education.
3. Mellor, L. (2008). Creativity, originality, identity: investigating computer-based composition in the secondary school. *Music Education Research*, 10(4), 451-472. Retrieved from: <http://ez-proxy.bathspa.ac.uk:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&Auth-Type=ip,shib&db=aph&AN=35581955&site=eds-live>

Published:

Byrne, J. (2018) *Sempre MET2018: Researching Music, Education and Technology*. London, March 2018. London: Sempres.