THE CREATIVE PROCESS OF COMPUTER-ASSISTED COMPOSITION AND MULTIMEDIA COMPOSITION — VISUAL IMAGES AND MUSIC

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A thesis submitted in total fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education, Portfolio of Design and Social Context

Royal Melbourne Institute of Technology (RMIT University)

Dec 2006
DECLARATION

To the best of my knowledge and belief, this thesis contains no material previously published or written by any other person, except where due acknowledgment has been made in the text.

This thesis has not been submitted previously, in whole or in part, to qualify for any other academic award.

The content of this thesis is the result of work which has been carried out since the official commencement date of the approved research program.

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Chi Wai Chen
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**TERMS AND ABBREVIATIONS**

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<td>Advanced Level</td>
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<tr>
<td>AS level</td>
<td>Advanced Supplementary Level</td>
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<tr>
<td>BA</td>
<td>Bachelor of Arts</td>
</tr>
<tr>
<td>CAI</td>
<td>Computer-Assisted Instruction</td>
</tr>
<tr>
<td>CAL</td>
<td>Computer-Aided Learning</td>
</tr>
<tr>
<td>CASH</td>
<td>Composers and Authors Society of Hong Kong Limited</td>
</tr>
<tr>
<td>CBE</td>
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</tr>
<tr>
<td>DMus</td>
<td>Doctor of Music</td>
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<td>EMB</td>
<td>Education and Manpower Bureau</td>
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<td>HKADC</td>
<td>Hong Kong Arts Development Council</td>
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<td>Hong Kong Certificate of Education</td>
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<tr>
<td>HKEAA</td>
<td>Hong Kong Examinations and Assessment Authority</td>
</tr>
<tr>
<td>HKIED</td>
<td>Hong Kong Institute of Education</td>
</tr>
<tr>
<td>HKTVB</td>
<td>Hong Kong Television Broadcast</td>
</tr>
<tr>
<td>HSBC</td>
<td>Hong Kong and Shanghai Banking Corporation Limited</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>ISCM</td>
<td>International Society of Contemporary Music</td>
</tr>
<tr>
<td>ISME</td>
<td>International Society for Music Education</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>Key Learning Areas</td>
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<td>Leisure and Cultural Services Department</td>
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<td>MA</td>
<td>Master of Arts</td>
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<tr>
<td>MMus</td>
<td>Master of Music</td>
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<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>MPhil</td>
<td>Master of Philosophy</td>
</tr>
<tr>
<td>MIDI</td>
<td>Musical Instrument Digital Interface</td>
</tr>
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<td>MMLC</td>
<td>Multimedia Computer Laboratory</td>
</tr>
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<td>MÜST</td>
<td>Music Copyright Intermediary Society of Chinese Taipei</td>
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<td>NSS</td>
<td>New Senior Secondary</td>
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<td>PC</td>
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<td>TBE</td>
<td>Technology-Based Education</td>
</tr>
<tr>
<td>SMPTE</td>
<td>Society of Motion Picture and Television Engineers</td>
</tr>
</tbody>
</table>
GLOSSARY

Frame
A film is a strip of thousands of photographs passing through a lens, which gives an illusion of movement. Each individual “photo” is called a frame.

Sync point
A point in the action that a composer accentuates on a musical accent.

Mickey mousing
When the music mimics the action exactly, the phrase refers back to the computer animation where the music followed the actions of the characters almost beat by beat.

Click track
A click track provides the tempo that the conductor and musicians hear during a recording. Whereas metronome markings are measured in beats per minute (BPM), traditionally film click tracks were measured in frames per beat (FPB). This enables precise synchronization of the music with the film.

Clock
A stop clock (now simply called a clock) was used in the synchronizing of music within a film. The clock method allows some flexibility in the music but its accuracy for sync points is only plus or minus a third of a second.
Wild

A cue is recorded without clicks, punches and streamers, or the use of a clock is called recording wild.

Sequencing

Some film composers do not use timing notes in the traditional way. They prefer to play along with the video on a keyboard until they get an idea that they like. Sometimes they establish a specific click in advance because they know where they want to hit the action.
I would like to thank God for giving me the wisdom to study the PhD. Throughout the studies, my PhD supervisor, Dr. David Forrest has given me helpful advice and professional guidance in the development of the dissertation. His warm support is crucial in my doctoral journey and academic life experience. Besides, I would like to thank the participants and my research assistants involved in the study. Finally, I would like to thank my wife, Yee Hung and my daughter, Grace for their fully support in the study.
ABSTRACT

This research study investigates how music technology can enhance and develop the musical ideas of students, focusing on the creative processes involved in computer-assisted composition and multimedia composition. The study investigates the Creative Multimedia Music Project, a module of the Associate of Arts (Music) Degree where students are using computers as music workstations. The aims of the study are (a) to evaluate the use of music technology for composing; (b) to describe the creative process of composing and investigate how the students comprehend this; and (c) to analyze the relationship between the creative process of the musical treatment and the visual image in multimedia composition.

The study is conducted in an exploratory, self-directed environment where the students make musical decisions about their compositions. From the preliminary survey, 10 out of 45 music-major students (Year Two) from the Associate Degree Music Program at the Hong Kong Institute of Education (HKIEd) were selected.

Composition activities took place over 15 sessions. The first phase focused on computer-assisted composition and the second phase focused on multimedia composition. The students attended lectures on alternate weeks. This gave them enough time to compose in the laboratory or at home, allowing them to explore, make decisions, and evaluate decisions. Data were collected from four sources: (1) written reports including a musical analysis of the creative process, (2) one-to-one interviews conducted during and after the creative process (15 questions were asked in each phase), (3) self-reflective journals that students maintained during their creative process, and (4) MIDI file observations after the creative process had occurred. After
data collection, commonalities between each of these data sources were analyzed. This highlighted that during the creative process, a developmental pattern emerged that extends Webster’s model (2003) of creative thinking in music. The relationships between the findings and the literature review were articulated to reinforce the creative thinking model, trends, and perspectives from different sources.

Through an analysis of these students’ creative processes and the strategies they adopted while composing with music technology, research projects such as this one may provide composers, music technologists, and music educators with insights into how students approach the task of composing using music technology. The findings might prove as a useful guidance to music educators on how to structure computer-assisted composition and multimedia composition programs for different age groups from school to university.
CHAPTER 1
INTRODUCTION

This chapter provides an overview of the study. Firstly, the aims of the research and its rationale, including the importance of undertaking this study, are laid out. Then, the research questions and an overview of the methodology provide the direction for the study. Finally, the main definitions are outlined.

1.1 THE AIMS OF THE RESEARCH

With the recent changes and developments in music technology, the approaches to composition both in music and multimedia are undergoing significant changes. The aim of this study is to:

1. Observe, record, and analyze the enhancement of students’ musical creativity through their use of music technology.
2. Investigate the education value of how to treat the visual images with different musical elements in a multimedia setting.
3. Explore the students’ thinking skills during the creative process of music composition.
4. Propose a framework of computer-assisted and multimedia composition.

1.2 SCOPE OF THE STUDY

The scope of this research includes:

1. An analysis of the process of music composition undertaken with computer software and a music workstation.
2. A qualitative analysis of written reports, interviews, reflective journals, and
MIDI file observations to determine how music technology affects decision-making in the compositional process.

3. A comparative analysis of written reports, interviews, reflective journals, and MIDI file observations to determine how the students deal with an open-ended task and a prescriptive task using visual images in a computer-animated motion picture for the compositional process.

4. The results of the study and a survey of relevant literature with regard to computer-assisted composition and multimedia composition. These seek to inform and to expand the proposed model of the creative process.

1.3 RATIONALE

Students entering university today are more familiar with technology than those entering university 20 years ago. They already incorporate some form of technology into their everyday lives. Cheung and Yip (2004) conducted a survey on the use of information technology (IT) in music teaching and learning in Hong Kong schools. They found that music educators mainly emphasized the importance of IT for lecturing (59%), music appreciation (58%), web searching (56%), and demonstrations (49%). Only 34% of music teachers used technology in music classes for composition purposes and only 16% used it for music arrangement. Only a small percentage of music teachers used music technology for composition and arrangement within music education in Hong Kong. This reveals a need for more in-depth study into creativity, music technology, multimedia, and composition. This research has been conducted to explore the possibilities for composing using music technology in Hong Kong. The use of music technology in composition in Hong Kong schools can pave the way for the students to compose with technology when they enter university. Due to the implementation of the New Music Secondary (NSS) music curriculum in 2009, the
importance of computer-assisted composition at the tertiary level is increasing especially for teachers’ training in music arrangement. Seminars and workshops by the Education and Manpower Bureau (EMB) for teachers in teaching computer-assisted composition were held in 2006 and 2007 to prepare these needs. Therefore, music teachers’ training is crucial in applying music technology in computer-assisted composition and multimedia composition to cope with these changes.

Over the past two decades, there has been significant research in the field of music; for example, technology-based composition in the study of the creativity in music (Williams & Webster, 2005); the teaching of and learning about music technology (Rudolph, 2005); musical thinking and music technology (Moore, 1989); the teaching of and learning about hardware and software design (Collins, 1992); the use of MIDI in composition (Reese, 1995); the balance of structure and freedom in the compositional process (Ladanyi, 1995); the horizontal and vertical approaches in composition (Folkestad, 1996); the autoethnographic approach that combines composing with computers and journaling (MacInnis, 1996); the thinking process involved in composing at the computer (Younker, 1997); intrinsic motivation (Cheung, 2001; Merrick, 2003); conceptualising composing as problem-solving (Berkley, 2004); musical creativity and music technology (Crow, 2006); and organizing sound through the use of music technology (Savage, 2005). However, the number of studies at the college or tertiary level is small. The use of visual images in the multi-media composition is increasingly popular. Relevant study would pave the way for teachers and students to prepare for this trend in composing for the media. The framework of this research is to explore students’ thinking skills and their musical developments while carrying out computer-assisted composition and multimedia composition and
possibly these research findings would contribute to the teaching and learning using music technology to compose at the tertiary level.

1.3.1 Broader Elements of the Rationale

Four broader elements support the rationale:

1. The rapid development of music technology.

2. The increasing application of music technology to music composition over the last decade.

3. Contemporary practice. The technological links between computer-assisted composition, multimedia composition, and creativity are operating today as reflected in music production (e.g., film scoring, music arrangement, and original compositions).

4. The interaction between visual and musical elements through Information and Communication Technology (ICT) is now part of the music and arts curriculum for Hong Kong schools.

1.3.2 Definition of the Problem

Leung (2002) stated that “creative activities are often neglected because the equipment and accommodation in Hong Kong schools discourage small group activities, especially practical activities that may involve small groups of children working on performances or compositions” (p. 2). In Hong Kong, students in primary and secondary schools have limited opportunities for undertaking compositional activities within the current musical environment.

According to the Curriculum Development Council (CDC) of the Hong Kong Education and Manpower Bureau (EMB), the revised music curriculum for schools
emphasizes both creativity and ICT. Through the incorporation of music technology, creative ideas and thoughts in composition can be developed. The use of computer workstations in multimedia computer laboratories (MMLC), in both primary and secondary schools, may overcome the problems of undertaking group activities with large class sizes, the lack of music room space, and the availability of different instruments. The lack of using music technology and creative music activities in primary and secondary schools will undermine the students’ development of musical creativity through the use of technology in the later stage at tertiary level. In this research, the possibility of the linkage between music technology and creativity will be explored.

1.4 RESEARCH QUESTIONS

Four research questions are posed to guide this study:

1. How does music technology enhance the creative process of computer-assisted composition and multimedia composition – considering both the visual image and the music?

2. How do the selected participants respond to computer-assisted composition?

3. How does the visual image interact with the musical elements in multimedia composition?

4. What developmental patterns emerge as a result of research questions 1, 2, and 3 above?

1.5 METHODOLOGY

As the focus of this study is to investigate how students compose using technology, a descriptive approach using qualitative methods was adopted. Case study methodology by Yin (1994) was adopted to compare the alternative descriptions or explanations of
these 10 participants. A multiple-case report was presented in a question-and-answer format in chapters 4 and 5, the advantages are potentially enormous. Yin reported that “a reader need only examine the answers to the same question or questions within each case study to begin making cross-case comparisons because each reader may be interested in different questions. The entire format facilitates the development of a cross-case analysis tailored to the specific interests of its readers” (1994, p. 135). To describe students’ thoughts and the strategies they employ when composing with technology, the following data-gathering techniques were used: semi-structured interviews, reflective journals, written reports, and MIDI file observation. Semi-structured interviews were conducted during and after the composing process in order to gather information about students’ composing processes. The reflective journals were used to record students’ decision-making and problem-solving techniques. Students’ written reports were analyzed for information about how the musical elements work in their composition, supporting the findings of other interviews and journals. Lastly, MIDI file observation through sequencing software was used to enhance the data collected. The triangulation procedure was refereed to Patton (2002)’s definition of triangulation that “one important way to strengthen a study design is through triangulation” (p. 187). Therefore, methodological triangulation was used in this study – the use of multiple methods to study a single problem. A detailed description of the methodology will be given in Chapter 4. The study was conducted in a computer music laboratory at the Hong Kong Institute of Education.

The research design was based upon data collected from the module Creative Multimedia Music Project taught from September 2003 to June 2004 at the HKIEd.
This module introduces students to composition with music technology and prepares them to compose through MIDI, arranging and scoring for pictures and images. The module involves two creative music tasks for the students. The first task is composing with MIDI and the second task is scoring for a computer animation. This study followed the design and presentation of the creative projects by the students. Analysis of students’ MIDI files, as well as their self-reflective journals and the interviews conducted with them, was carried out. A preliminary survey was conducted with students from the Associate of Arts Degree (Music) in 2003 in order to investigate the students’ experience and background in composition with music technology. An important component was finding out about the students’ education and experience of music technology in secondary school. The use of multiple data-gathering techniques allowed the researcher to verify the information gathered through each source. In chapter 4, the description of each technique is given.

1.6 MAIN DEFINITIONS

The following terms are used throughout this study. The definitions will be explained more explicitly in the literature review (chapter 3).

1.6.1 Creative Process and Product

The creative process refers to the procedure that a person is involved in when generating a creative product. This procedure may include problem-solving; collecting ideas; and generating, selecting, rejecting, and verifying the creative product.

1.6.2 Computer-Assisted Composition

Computer-assisted composition refers to music technology that can expand the
horizons of musicality if the music technology allows people to be creative in their
decision-making through sounds, the storage and instant retrieval of sounds, as well as
devices to alter and refine previous decisions. This would enable “genuine
compositional creativity” (Reese, 2001, p. 43).

1.6.3 Multimedia
Multimedia is defined by Cook (1998) as the “perceived interaction of different
media” (p. 106). In this study, multimedia is viewed as one entity that includes
multiple visual and aural forms, such as text, stills, animated images, and sound.

1.6.4 Creativity
In this study, the researcher regards creativity as being related to both the individual
and the process. From this perspective, it is the background and prior experience of
the person, as well as the process of creating the product. In this study, Webster’s
(2003) model of creative thinking is adopted. This model was considered as a
dynamic mental process alternating between divergent (imaginative) thinking and
convergent (factual) thinking. Divergent thinking involves generating as many
solutions as possible for a specific problem. Convergent thinking involves evaluating
the various possibilities and converging on the best solution.

1.6.5 Digital Audio Workstation
The digital audio workstation software is equipped with software plug-in synthesizers,
samplers, and virtual instruments. It is an all-in-one virtual studio piece of software,
and programming features include sound shaping and synthesis to create and combine
sounds.
1.6.6 Music Sequencing and Music Notation

Music sequencing is a term most commonly used to describe multitrack music recordings by composers working with electronic and digital media. Music notation software allows users to enter, edit, transcribe, and transpose music. Users also have the ability to print full scores and extract selected parts from scores.

1.6.7 Composing Strategy

A composing strategy is how a participant succeeds in solving a task set in a particular situation. The use of a particular musical style is part of the decision-making reflected in the creative process.

1.7 DELIMITATIONS

The purpose of this section is to set out the general boundaries of the entire study in terms of what the study will not attempt to cover. In this research, the scope of the study will focus on 10 participants from a teacher training institution at the tertiary level in Hong Kong. Furthermore, the software used in the computer lab is sequencing software, Sonar and some other notational software, such as Finale is available for inputing and printing scores.
1.8 OVERVIEW OF CHAPTERS IN THE STUDY

The thesis is organized into eight chapters. It includes the introduction (chapter 1), background to the study (chapter 2), review of the literature (chapter 3), the research design and methodology (chapter 4), presentation of the data – task one (chapter 5), presentation of the data – task two (chapter 6), analysis of the data (chapter 7), and the conclusions and recommendations (chapter 8).

The background to the study (chapter 2) presents information on the local context that is relevant to the study. It includes information about the HKIEd, the music curriculum of secondary and primary schools in Hong Kong, the development of music technology in education, and the composition environment in Hong Kong.

The review of the literature (chapter 3) includes four main sections. The first section provides an overview of music technology, the functions of music technology, computer-assisted composition, and multimedia composition. The second section centers on the creativity of children and adults, looking at the creative person, creative processes, and creative products. The third section looks at composing strategies, improvisation, style genre and musical languages. The fourth section focuses on the research into composition and particularly composition by means of computer.

The research design and methodology of the study (chapter 4) is divided into four sections. The first section contains the research design, program, plan, and the hardware and software used in the study. The second section consists of the procedure, stages, survey, subjects, tasks, instructions, and musical concepts undertaken during each session of the project. The third section provides a description of the methods employed in data collection: semi-structured interviews, reflective journals, written
reports, and MIDI file observations. The fourth section contains the procedures used in the analysis of the data.

The presentation of the data from task one (chapter 5) includes the results of the survey and the profiles of the participants. The results of the analysis of the written reports, the individual interviews, the self-reflective journals, and the MIDI file observations are presented. The results are illustrated using tables, charts, and MIDI files.

The presentation of the data from task two (chapter 6) includes the results of the comparative analysis of two different versions of the video clip. The results of the analysis of the written reports, individual interviews, self-reflective journals, and the MIDI file observations are presented. The results are illustrated using tables, charts, and MIDI files, especially dealing with the musical treatment of the visual images.

The analysis of the data (chapter 7) brings together the findings from chapters 5 and 6 to present a comprehensive picture of the creative process carried out in the two tasks. The chapter is divided into five sections. The first section contains profiles of each participant and addresses research questions 1, 2, and 3. The second section includes analysis of the four data sources to address research question 4. The descriptions in this analysis focus on the commonalities of the processes exhibited in each task. The third section presents the developmental patterns emerging from the analysis that extend Webster’s creative thinking model (2003). The fourth section discusses the findings from the developmental patterns with regard to the review of the literature. The last section compares the similarities and differences in the creative process of computer-assisted composition and multimedia composition.
The final chapter (chapter 8), conclusions and recommendations, responds directly to the research questions, considers the implications of the study, and presents recommendations for the future development and research of this topic. The chapter is divided into three sections. The first section contains a summary of the research carried out in this study. The second section outlines the significant findings with regard to all of the research questions. The third section looks at the implications of the research, discusses its significance for musical education—current and future practice, and makes recommendations for further research.
CHAPTER 2
BACKGROUND TO THE STUDY

This chapter presents background information relevant to this study. It focuses on five related areas: (1) the Hong Kong Institute of Education, (2) the Associate of Arts (Music) Degree Program, (3) the music curriculum of secondary schools and primary schools in Hong Kong, (4) the development of music technology in education, and (5) the music composition environment in Hong Kong.

2.1 HONG KONG INSTITUTE OF EDUCATION

The Hong Kong Institute of Education (HKIEd) was established in 1994 on the foundations of 65 years of teacher training in Hong Kong’s former Colleges of Education. The HKIEd is the only University Grants Committee funded institution dedicated solely to train and educate teachers in Hong Kong (www.hkied.edu.hk). As the largest teacher education provider, the focus of the HKIEd remains on teacher education. The programs at the Institute reflect the integration of subject knowledge with pedagogy and teaching skills. The academic planning processes ensure that the programs meet and respond to the current and future needs of teachers. In 1997, the Institute moved to its consolidated campus in Tai Po in the New Territories. Additional facilities such as the HKIEd HSBC Early Childhood Learning Centre and the HKIEd Jockey Club Primary School were established on the campus in 2001 and 2002 respectively. These demonstrate innovative practices and provide support for the student teachers. The Institute was granted self-accrediting status in 2004. Currently, the HKIEd grants postgraduate and undergraduate degrees, postgraduate diplomas, certificates, and a range of in-service programs to around 7,000 preservice students and serving teachers.
2.2 ASSOCIATE OF ARTS (MUSIC) DEGREE PROGRAM

This study involved students from the Associate of Arts (Music) Degree Program. The following information describes the content of the program and the level of the students in the research study.

According to the HKIEd website (www.cpe.hkied.edu.hk), this 2-year full-time music program aims to provide a solid foundation in the practical use of music knowledge and musicianship. It prepares students for further education and focuses on jobs related to the disciplines, such as music education, music production, and music composition. The program focuses on the analytical skills, creative thinking, and the musical thinking of the students that are required as a composer, musician, educator, or administrator. The program provides:

1. An articulation to bachelor degree programs of local and overseas universities.
2. Both specialized knowledge and generic skills as a balanced curriculum.
4. A total of 160 hours of industry experience to prepare students for future career development.

Upon successful completion of the program, students are expected to have:

1. A solid foundation in music for further academic and career development.
2. Developed the skills of aural perception, analysis, musical thinking, and problem-solving in context.
3. Developed professional knowledge about the applications of music technology.
4. Be equipped with the principles of music education in a private or classroom teaching environment.

5. Developed the skills of music administration and management in the music industry.

Students can choose any four modules from the list of music electives. By following the recommended combinations, students can focus on a specific area. The three areas of focus are:

1. **Music Education**—Pedagogical elements are well-suited to students who aspire to a teaching career.

2. **Music Production**—Practical production elements are available to students who have the necessary skills and aspire to a career in music production.

3. **Music Composition**—Music composition elements are included for students who aspire to a career in composition and performance. (Associate Degree Prospectus, HKIEd, pp. 22-23)

Figure 2.1 shows the program structure. It consists of eight modules from the area of specialization (core) and four modules from the open electives which are grouped into three areas: music education, music production, and music composition. In total, there are 13 modules specializing in music, excluding the generic-based skills module which is not music related.
In the work-based studies shown in Figure 2.1, the professional study Creative Multimedia Music Project is designed to provide students with experience in developing a creative music project that utilizes a range of media including sound wave, MIDI music, pictures, and video. Based on the knowledge and skills obtained from the prerequisite modules, students will continue learning how to apply various software programs especially suitable for music creation.

In Table 2.1, the patterns of study are illustrated. Students need to have a total of 66 credits, which include the industry attachment to graduate in two years.
Table 2.1

*Patterns of Study*

<table>
<thead>
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<th>Year</th>
<th>Number of Modules</th>
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<tr>
<td>Year 1</td>
<td>11</td>
<td>33</td>
<td>495</td>
</tr>
<tr>
<td>Industry Attachment (160 hours)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2</td>
<td>11</td>
<td>33</td>
<td>495</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>66</td>
<td>990</td>
</tr>
</tbody>
</table>

(Associate Degree Prospectus, 2006, p. 23)

2.3 MUSIC CURRICULUM OF SECONDARY AND PRIMARY SCHOOLS IN HONG KONG

This section provides background information on three areas highlighted in the 2003 Curriculum Development Council (CDC) document which includes: (1) the recent development of the music curriculum in secondary and primary schools (Primary 1 to Secondary 3); (2) the new secondary school music curriculum (Secondary 4 to Secondary 6); and (3) the recent development of music technology in education in Hong Kong.

2.3.1 Key Learning Area of the Music Curriculum Guide in Creativity (Primary 1 to Secondary 3)

The Hong Kong Education and Manpower Bureau proposed a holistic curriculum reform in 2003, in which eight Key Learning Areas (KLA) were identified. Like visual arts, music remains a core subject in the KLA of arts education. However, different strands of other arts disciplines were introduced to the KLA of Arts
Education, which included dance, drama, media arts, as well as other emerging art forms. The major focus of the 2003 CDC document is on the four learning objectives for arts education:

1. Developing creativity and imagination: Students should be able to conceptualize ideas through imagination and creativity by participating in creating and/or performing in arts activities.

2. Developing skills and processes: Students should be able to know and use arts materials, elements, and resources to facilitate learning.

3. Cultivating critical responses: Students should be able to respond to and appraise issues in the arts as well as in the inner and outer worlds.

4. Understanding arts in context: Students should be able to understand the cultural dimensions of the arts and their contributions to peoples’ lives and the society at large. (CDC, 2003, pp. 12-13)

According to the Hong Kong Curriculum Reform of 2003, the development of creativity through arts education is identified as a core learning objective. Creativity in the arts is indicative of general creativity and identified as one of the essential generic skills to be developed through education. The current music curriculum’s development with regard to creativity and imagination can be illustrated by the learning objectives of the four targets in Key Stages 1 to 3 of the curriculum guide.

Key Stage 1: Students will learn to create/improvise music using basic music skills, simple musical ideas, and different sounds; and to create/improvise movements to reflect different qualities of music.

Key Stage 2: Students will learn to create/improvise music with structure and organization.
Key Stage 3: Students will learn to create/improvise music for specific purposes, demonstrating their grasp of creating skills and making use of IT to create music. (CDC, 2003, p. 14)

The learning is progressively arranged under the four learning objectives to coincide with the average student’s abilities in musical development. The objectives assist teachers in designing integrated activities and modes of assessment.

2.3.2 New Senior Secondary Music Curriculum in Creativity (Secondary 4 to 6)
The senior secondary music curriculum continues the development of musical education offered in basic education. It involves a 3-year course designed for students who choose music as an elective subject, leading to an examination provided by the Hong Kong Examinations and Assessment Authority (HKEAA). The New Senior Secondary (NSS) School Examination (Music) will replace the Hong Kong Certificate of Education (HKCEE) and Hong Kong Advanced Level (A-Level) and Advanced Supplementary Level (AS Level) music examinations.

The New Senior Secondary Curriculum and Assessment Framework in Music (2005), proposed that

through a range of rich music learning experiences involving listening, performing, and creating, the recommended Senior Secondary Music Curriculum aims to develop students’ creativity, critical response, and music skills to the full extent and to broaden their music horizons and nurture their cultural awareness. The curriculum is designed with a view to cater for the
diverse music backgrounds and strengths of students. Students can choose to perform and compose music in the style of Western classical music, Chinese music, Cantonese operatic songs, and popular music. (CDC, 2005, p. 1)

This reveals that a more diversified music curriculum is encouraged through the use of different types of music, such as Chinese music, Cantonese operatic song, and popular music. Students not only concentrate on Western classical music, but require a broader perspective to study music in the NSS School Examination for Music (2005).

In the assessment of the compulsory module Creating I, it requires students to

1. Create two or more compositions in a variety of styles which display a structural design.
2. Arrange one music piece.
3. Present a reflective report to record and display the creating process of each composition. The report may include the aims, the development of music ideas, compositional devices, refinement of the composition, performance practice, the use of IT, and a list of the reference repertoire.
4. A record and score of the compositions have to be submitted.

(CDC, 2005, p. 9)

To cope with the NSS music curriculum, this research explores the possibility of using music technology to compose in the creating module. From the compulsory module of creating in the NSS music curriculum, the creative process is emphasized in the assessment. This research will investigate how the students involve different problem-solving skills during the creative process from their reflective journal. The student has to submit a reflective journal that records and displays the creative process
for the compositions. In the NSS creating module, the use of IT and a list of references are emphasized as important for the student’s journal. The music software and hardware can be used as a tool to compose in this context to further develop the creativity of the students. The student’s reflective journal can be one of the tools in both research and assessment. The possibility of using a reflective journal during the creative process as part of the assessment will be explored in this study.

2.3.3 The Development of Music Technology in Education in Hong Kong

According to the Curriculum Development Council (CDC, 2003) *Music Curriculum Guide*, the music technology facilitates a favourable learning environment for students; one in which they can access a rich source of information and communicate with the outside world:

Student-centered learning is thus supported. Apart from tape recorders, compact disc and video players, the commonly used IT equipment in music lessons includes the computer and a series of peripherals such as the synthesizer, MIDI keyboard, mixer, and music software. (CDC, 2003, p. 64)

Through the use of music technology, students can explore, create, and experience music in an active manner and their intrinsic motivation is enhanced (Cheung, 2001). For students who are not familiar with staff notation or instrumental techniques, they can still learn to create music by using sequencing, wave editing, or notation software in their music composition. Students can use computers and related software to improvise, arrange, perform, and record music. The software provides students with the opportunity to listen to their creative product immediately and make revisions at any time.
According to the *Music Curriculum Guide*, the music room at school should have at least one set of music workstations where each workstation includes a computer with a sound card, a MIDI keyboard, speakers, a headphone, and a printer. Almost all of the secondary schools in Hong Kong are equipped with a computer room with 40 stations for students to use. Therefore, these can support the IT needed for music teaching and learning as the software and MIDI keyboard can be easily installed and connected to a computer. In short, “the music hardware and software can be used in the computer laboratories already existing in the Hong Kong school setting” (CDC, 2003, p. 65).

Yip (2003) studied the existing education about technology in the curriculum of music teachers; whether the theories student teachers learnt were significant for their teaching of musical education. Yip’s (2003) research findings revealed that:

The self-rating of students on the familiarization with MIDI basics were 3% very good, 37% good, 53% average, and 7% weak. For their familiarity with the presentation program *Powerpoint*, the rating was 60% good. There were two modes for familiarity with web search with 40% showing either very good or good. The generic skills of downloading text, pictures, or graphics also showed a mode on the good range, a similar rating as students’ familiarization with presentation programs and web searches. The mode of student downloading MIDI files, videos or MP3 were on the average range, signaling that the generic skills of students were better than their music-related technology skills that
should be attended to. (p. 434)

These findings show that the student teachers were more familiar with generic computer skills than the use of MIDI, sequencing, and notation software for teaching music. This emphasizes the need for conducting research into music technology, creativity, and composition in order to provide a better music technology education for student teachers in Hong Kong.

To summarize, the *Music Curriculum Guide* (CDC, 2003) and Yip’s (2003) research findings highlight that a lack of resources is a major factor in explaining why student music teachers were not able to apply technology in their teaching. Other factors included insufficient time and problems with the implementation of the curriculum. In the context of incorporating music technology into education in Hong Kong, the following study is undertaken to explore the possibility of using music technology to compose and therefore enhance creativity in music from the school to the tertiary level.

### 2.4 THE COMPOSITION ENVIRONMENT IN HONG KONG

This section is a discussion of the cultural policy of the Hong Kong Arts Development Council (HKADC), the recent music curriculum implemented by the Education and Manpower Bureau (EMB), the significant role of the Composers and Authors Society of Hong Kong Ltd. (CASH), and the music composition programs offered by tertiary institutions. The interrelationships among these organizations and the sources of funding available from them will also be discussed.
2.4.1 The Cultural Policy of the Hong Kong Arts Development Council

The past few years have seen some great changes in local cultural and arts development in Hong Kong. No overall cultural policy was in place under the former British administration. In 1997, Mr. Tung Chee-hwa, Chief Executive of the Hong Kong Special Administrative Region, mapped out in his first policy address a blueprint for the implementation of cultural policy and organizational restructuring. From the year 2000, the Culture and Heritage Commission, the Home Affairs Bureau, the Leisure and Cultural Services Department (LCSD), and the HKADC have formed a new administration structure to promote culture and the arts. Mr. Tung laid down the goal of transforming Hong Kong into a cultural metropolis; a goal that combined ideas for cultural development, civil education, and tourism. All the following measures have heightened the community's support for and awareness of culture and the arts.

Creative Hong Kong

The 5-year strategic plan was launched in 2000 and named Creative Hong Kong. It has four developmental strategies: (1) to develop the social functions of the arts; (2) to expand the market for the arts and encourage audience participation; (3) to promote life-long arts education for all; and (4) to enhance the artistic level and social status of artists (HKADC, 2000). Therefore, this plan significantly develops the importance of arts education and upgrades the status of local artists by focusing on the arts as a leisure activity for the residents in Hong Kong and creating more audience participation.
Cooperation with Arts Education

As culture, art, and creativity are integral parts of an arts development proposal, the education reform in 1999 could solicit comprehensive public feedback. Following this, arts education was incorporated into the eight Key Learning Areas of the compulsory curriculum and for the first time, the role of arts education was formally recognized in Hong Kong’s school curriculum.

Music Composition Proactive Projects

The proactive projects that involve composition in Hong Kong are the World Music Days and the Chinese Composers Festival run by the International Society for Contemporary Music (ISCM). Both of these projects facilitate cultural exchange between Chinese and international composers. The new HKADC policy and its sponsorship of the composition event support it in a proactive way. In fact, the HKADC has a strong relationship and plays an important role with the EMB—similar to the relationship between the Education Department and CASH.

2.4.2 The Composers and Authors Society of Hong Kong Ltd.

In 1946, the Performing Rights Society (PRS) of the United Kingdom set up an agency in Hong Kong to protect the music copyright of its members and members of its overseas affiliated societies. This agency conducted collections for performing royalties. Following the PRS in the United Kingdom, CASH was incorporated in Hong Kong in 1977. According to the organization’s website (www.cash.org.hk), the objectives of this society include: (1) administration and enforcement of the rights of composers and authors of musical works subsisting under the copyright law of the Hong Kong SAR; (2) the protection and administration of the rights of members in more than 130 countries throughout the world; (3) educating the public on copyright
issues to reinforce the public’s respect toward composers and authors, and to ensure that their creative efforts are properly remunerated; and (4) promoting and sponsoring musical activities, encouraging local composition, and awarding music scholarships to improve the local standard of music.

2.4.3 Policy for Funding Composition

The CASH Music Fund sponsors and promotes composing activities in Hong Kong. The distribution considerations mainly fall under three main categories: 1. concert and performance sponsorship, 2. competition sponsorship, and 3. education sponsorship.

1. Concert and Performance Sponsorship: *ISCM World Music Days 2002 Hong Kong*, an international contemporary music festival held in Hong Kong (for the second time since 1988) from 11 to 19 October 2002. The 9-day festival featured a total of 23 orchestral, chamber, solo and multimedia concerts; a sound installation exhibition; and three radio concerts. Over 100 contemporary works were performed by various local and overseas artists.

2. Competition Sponsorship: *CASH Song Writers Quest*, a pop songwriting contest, was organized by CASH and co-organized by Hong Kong Television Broadcast (HKTVB), Commercial Radio 2, the Music Copyright Intermediary Society of Chinese Taipei (MÜST), and East Radio Shanghai. The final concert was staged at TV City, Clearwater Bay, broadcast live on TVB Jade Channel, and is aired on Commercial Radio 2 annually.

3. Education Sponsorship: To foster students’ creativity through music and integrative arts, the CASH music fund sponsored the *Schools Creative Music Showcase*, an annual event jointly presented by the Hong Kong Composers’
Guild Ltd. and the EMB. This showcase aimed to provide students of primary and secondary schools with an opportunity to present their creative ideas on stage through musical performance. This multimedia project reflected a high degree of cooperation among the students and offers students valuable training in creativity, which is not found in traditional classroom teaching.

(CASH Flow, 2003)

The allocation of resources for the teaching of composition between university level and the primary and secondary school levels is rather unbalanced. Since the new curriculum was launched in 2003, more importance has been credited to creative music activities, and teacher training in composition and music technology has been acknowledged as playing a vital role in creative music making. Part of the CASH music fund is used to sponsor areas of the curriculum that focus on creative music making, and primary and secondary schools students will directly benefit from this funding. Similarly, Singapore held a MIDI composition contest in secondary schools. This was supported by the International Society for Music Education (ISME) and the Education Ministry in Singapore. In fact, the creative music showcase was treated as an extracurricular activity but had never been included as a major component of the music curriculum.

To summarize, the source of funding for composition is mainly from the royalties collected by CASH. The collaboration between the cultural policy of HKADC, the EMB proposed curriculum, and the university composition programs has a strong impact on the composition environment in Hong Kong. In order to foster creativity in music for the next generation, contests for creative music making or composing using music technology could be a cocurricular activity in the new curriculum for secondary
school students. Also, the possibility of offering a degree program in music production by universities could be a stimulus for the development of the music industry in Hong Kong. It would certainly give more opportunities to the next generation of local composers. At the same time, the government should take a wide perspective when establishing its cultural and education policies, so that composition activities can be maximized and so that sufficient resources and support are given to the composition environment in Hong Kong.

Figure 2.2 below illustrates the interrelationship of organizations supporting composition in Hong Kong. As identified, these organizations have a strong impact on the composition environment in Hong Kong.

*Figure 2.2 Flowchart Illustrating the Policy and the Interrelationship of Organizations Supporting Music Composition in Hong Kong (Chen, 2004, p. 24)*
2.4.4 Opportunities for Secondary School Students to Study Music Composition in Hong Kong

In Hong Kong, there are four institutions that offer composition as part of their undergraduate and postgraduate programs:

1. The Chinese University of Hong Kong offers composition as a major in its BA, MMus, and DMus programs.
2. Hong Kong Baptist University offers composition as a major in its BA, MA, MPhil, and PhD programs.
3. The University of Hong Kong offers composition as a major in its BA, MPhil, and PhD programs.
4. Hong Kong Academy for Performing Arts offers composition as a major in its Diploma, Advanced Diploma, Professional Diploma, Bachelor of Music, and Master of Music.

Hong Kong secondary school students have a range of programs to choose from if they wish to pursue studies in composition in Hong Kong. All the composition programs mentioned above place a strong emphasis on contemporary composition. If a student aspires to follow a career as a musician or composer in commercial music, he or she would not be able to find a place at the postsecondary level in Hong Kong to study particular aspects related to the music industry.

Because all four institutions have similar programs in composition, it is feasible that other universities could offer popular music programs, like the one offered in South East Asia by Berklee College of Music in Boston, which would support the CASH
funding policy for the Hong Kong music industry. A comprehensive composition policy could enhance the connection between university programs, the CASH music fund, the ADC cultural policy, the new curriculum from the EMB, and related performing arts organizations, as well as the broader music industry.

2.5 SIGNIFICANCE DRAWN FROM THE BACKGROUND TO THE STUDY

The background to the study provides a descriptive overview of how the music technology and music composition integrated into the university programs and the music curriculum of secondary and primary schools in Hong Kong. Discussion of the composition environment gives an overview of the funding policy in composition and the interrelationships between organizations such as EMB, HKADC, CASH, and tertiary educational institutions. Since this research study focuses on the local context, it is important to examine how computer-based music composition is adopted as part of future practice in Hong Kong’s music curriculum as this has implications for music education and music composition. The overall policy and composition environment directly links to the research questions one and three in using music technology to compose for visual images in multimedia composition.

The background to the study highlights that the development of music technology at the school to the tertiary level is transformative. The transformative use of technology refers to the advanced implementation of technological applications in ways beyond conventional approaches that fit within the current institutional settings. The use of technological applications has to be both contextual and institutional. It implies that the computer-based composition environment can be developed from the primary school level to the tertiary and professional level. Computer-based composition may give more opportunities to students at every level to experience the creative music
environment that both contributes to and promotes the overall composition environment in Hong Kong.
CHAPTER 3
REVIEW OF THE LITERATURE

3.1 INTRODUCTION

The main aim of this study is to look at computer-assisted music composition and multimedia music composition. One intention is to identify and describe qualitatively how music technology can enhance students’ musical creativity in computer-assisted and multimedia composition. Another intention is to investigate the relationship between music technology, composition, creativity, and multimedia in Hong Kong. In the first section of the literature review, the definitions and the functions of music technology, computer-assisted composition, and multimedia composition are investigated. Then, music composition using other media, and with particular consideration of the alignment between visual images and music, is discussed. The second section centers on the creativity of children and adults with regard to creative processes and creative products. The third section focuses on the style, genre, and musical language used in students’ musical creations; composition as problem-solving; and composing strategies. Finally, the fourth section focuses on research into composition and studies of computer-assisted composition. The purpose of the literature review is to provide information that would help the researcher determine how music technology enhances the creative process in composition, and to indicate how students could be educated to prepare for a multimedia environment in the fields of music education and composition.
3.2 MUSIC TECHNOLOGY OVERVIEW

The development of music technology has taken place with a constant dialogue between instrument makers and musicians or composers. In the 17th century, the church organ was developed in order to make it possible for the composer and performer to get access to the sounds of the orchestra (Davidson, 1991). In the 20th century, the development of electro-acoustic music started with the creation of the first electronic music studio in Paris by French composer and engineer, Pierre Schaeffers, in 1948 (Wiggen, 1971; Jones, 1992). This way of creating music, Musique Concrète, was able to manipulate the recorded sounds in a way that mechanical instruments [were] not capable of (Wiggen, 1971). One of the guiding aesthetic principles in electro-acoustic music was the idea of non-pitch-related music (Thorsen, 1991). This enabled the equipment to be directed by means other than the use of keyboards, on which the keys represented fixed pitches.

However, with the rapid increase in the development of music technology, this was soon displaced by the introduction of MIDI, which was used in the creation of popular music in the 1980s. The MIDI started a wide development in new ways of working with music, both in electro-acoustic music and in popular music. In the 1990s, digital technology accelerated the development of these new ways of working with music for professional composers and the younger generation. This setting of a new standard implied a change in the perspective from which the music is produced; a change from the perspective of professional music producers to the perspective of creative users. In this study, the perspective of creative users is adopted.
The term *music technology* is considered in different ways by Wishart (1992), Pellman (1994), Rudolph (2005), Webster (2001), Swanwick (2001), and Moore (1989). Rudolph (2005) defines *music technology* broadly, arguing that the phrase can be used to describe a wide variety of devices and applications in music and musical education. He argues that technology has assisted performers and music educators over the past centuries. He further explains that:

The organ, harpsichord, piano and phonograph are all examples of technology that were as amazing as the computer we use today. Technological devices can be either passive or interactive. Passive devices include the phonograph record player, cassette tape recorders, television, video cassette player, and overhead projectors. With passive devices, the student perceives the material but there is no interaction with the device or medium. Using a computer to produce sound or compose with software can be both interactive activities. Students can use technology to compose, perform, and learn music to embrace the philosophy of learning by doing. By general definition, technology can be thought of as anything that uses science to achieve a desired result. (Rudolph, 2005, p. 4)

Rudolph’s definition states that music technology can be passive or interactive. The interaction between students and teachers is emphasized in the teaching and learning of music technology such as the sequencing software and MIDI keyboard used on computer music workstations.

Pellman (1994) shared this broad perspective of *music technology* with Rudolph (2005). Pellman (1994) argued that:
The onslaught of technology continually impacted the development of music, through new musical instruments, and also through the expansion of musical knowledge base and the application of this knowledge to the creative process. As the application of technology was applied to music, new tonal structures, new harmonies, and new musical forms and more new musical instruments continued to emerge. (p. 394)

This implies that the development of music technology has had a direct impact on music structures, harmonies, and instrumentation. In this study, the impact of music technology is investigated with regard to the creative process of a student’s composition.

Wishart (1992) pointed out the relationships between music and technology: “music and technology have always been intrinsically bound up with one another. All musical instruments are technological extensions of our ability to make sounds by blowing, scrapping, hitting or otherwise exciting materials in the worlds around us” (p. 565). Wishart also argued that technology continually contributes to the application of knowledge and advancement, and has played a major role in the functioning of societies, including music and the arts.

Webster (2001) explored the definitions of creativity through his research and identified music technology as

inventions that help humans produce, enhance and better understand the art of sound organized to express feeling. Such a focus on inventiveness in service to music as art helps to place music technology historically and purposefully.
Music technology is more than designing a hardware solution to a music performance problem, more than learning how to use a music notation program. It is more than designing a multimedia presentation for a music history class or using an intelligent accompaniment program to help learn a new work. It is all these things plus a way of engaging with music in an effort to improve the musical experience while always respecting the integrity of the art. (p. 416)

Webster implied that the objective of using music technology is to improve the musical experiences of the students in an engaging manner. Webster (2001) also discusses that the term music technology should not be the focus of what musicians do but rather the means by which to make the musical experience better. Music technology has always played a major role in the development of music of all types and in all cultures. Certainly, the importance of technology in framing the musical experience in certain kinds of contemporary concert music is inspired by electronic music studios and in the continued development of popular music styles. In these styles, both the inspiration and production of the music are so closely connected to technological resources that the distinction of technology as only a tool becomes more obscure.

Swanwick (2001) described music technology as:

A term most often used in a limited sense that of the practical application of scientific knowledge. We ought to notice that the Greek origin of the term technology is ‘techne’, meaning art or skill, facilitates the articulation, interpretation and renewal of heritage. It is helpful to keep this broad, generic concept in mind, thus preserving associations with technique, a concept which is
very familiar to musicians. (p. 34)

This implies that the availability of technology may shape the way we function, and condition the way we think and feel. Any form of *techne* is a transforming medium, with the potential for changing minds and musical heritage. Therefore, music technology could be part of a transformative process that extends heritage.

Moore (1989) had a similar perspective to that of Swanwick (2001) that the term *music technology*, which is derived from the existing Greek words *techne* (art) plus *logos* (a word or discourse), is the sum of the total ways by which practical and aesthetic goals are realized. He also said that, “New technology allows traditional goals to be pursued in new ways or it allows new goals to be defined. Technology constantly modifies what goals are possible, it provides a vital and dynamic link between human imagination and reality” (p. 329). This implies that technology can further extend our goal with musical imagination.

For the purpose of this study, the term *music technology* refers to state-of-the-art devices such as the computer, keyboard, MIDI interface, sequencing software, sound modules, mixer, and digital audio recording. Music software and hardware can be considered as an instrument rather than merely computer technology. Music technology uses speakers to produce sound, so the sound module, sampler, and digital audio are actually considered as the tone generators and the MIDI keyboard is the triggering device.
3.3 MUSIC TECHNOLOGY FUNCTIONS

This section provides the definitions of music hardware and software that will be used in this research study. Most of the equipment discussed is the basic requirement for a computer music workstation. This includes MIDI, MIDI keyboard, sequencing software, track, patch, channel, quantizing, humanizing, sound modules, digital audio recording, mixer, video capturing, and synchronization with MIDI/audio tracks.

3.3.1 MIDI

The use of Musical Instrument Digital Interface (MIDI) can be divided into two levels. The first level is the communication between electronic instruments and computers. The second level is its use as a tool to conduct research in music education. With regard to the first level, Rudolph (2005) stated that:

> It is a digital computer language used to transmit information between electronic instruments and computers. MIDI is a non-proprietary hardware and software standard used for the interconnection of microprocessor-based musical instruments. (p. 76)

Thorsen (1991) elaborates further by stating that the MIDI system affects the way of composing with music: “The way of working with music used by professional composers was soon adopted by the younger generation. During the 1980s, independent musical activity was established in teenage culture, where production technique and creative music making came to be united” (p. 5). The MIDI system changed the way of composing and shifted composing from the professional composers to the younger generation.
On the second level, MIDI is an effective tool for conducting research in musical education, in particular to study the creative process of composition. Higgins (1992) described “MIDI parameters and how they might be used for research purposes and provided a resource guide of available hardware and software to aid in using MIDI in music research” (p. 488). Reese (1995) explained that “MIDI technologies are used as a means to develop music understanding, music sensitivity and compositional skills; these technologies are not studied for their own sake” (p. 200).

Furthermore, the status of MIDI was examined by Mager (2000) as part of the curricula of higher education institutions offering degree programs in music. Mager (2000) provided an assessment of current practice and made recommendations for the integration of MIDI into music programs. In Mager’s study, a large number of participants (81.1%) said that MIDI was being offered as part of their music programs. Most respondents (90%) believed that MIDI enhances the learning process in their area of teaching specialization, including basic MIDI theory, sequencing, and editor/librarian/notation. The four other topics in the study—synchronization/SMPTE, digital audio, General MIDI, and Internet access—received positive responses (between 50% and 65%). Most respondents also agreed that music technology was essential to musical education and composition. Mager (2000) implies that the use of MIDI can enhance the teaching and learning process in music theory, sequencing, and notation.
3.3.2 MIDI Keyboard

Rudolph (2005) points out that most electronic keyboards have a built-in computer interface and are excellent for connecting to a computer through MIDI. The function is to trigger notes from the sound module and input notes to be recognized by the sequencing software. Williams and Webster (2005) stated that

the MIDI controller is a device that translates music performance actions into MIDI data. Keyboard controllers are the most common type of MIDI controller. Most MIDI synthesizers come as a self-contained package with a built-in synthetic keyboard controller. The translation mechanism for both acoustic and synthetic keyboards is the touch sensitivity on each key. (p. 195)

3.3.3 Sequencing Software

Folkestad (1996) suggested that the sequencing software records information about the musical performance and stores it as digital data. These data can be easily modified. For example, if a passage is recorded using the sequencing software and a wrong note is played, the incorrect note is selected, and the correct note is typed in or replayed. Williams and Webster (2005) stated that

the sequencing software acts as a tool for capturing and working with MIDI and digital audio data, usually for the purposes of composition or arranging. This software lets you record multiple layers of information, much as you might record multiple layers of sound on an audio tape to construct a piece of music. (p. 351)

The sequencing software Sonar 3 is used for this research.
3.3.4 Track

Folkestad (1996) suggested that the sequencing software can also divide information into separate tracks for independent control over performance information, and can therefore function as a multitrack recording device. The sequencer can record from 8 to 1,026 tracks. Rudolph (2005) further explained that “when you record separate parts such as a bass part, chords, and melody, each is placed on a separate track” (p. 200). This means that after the information is recorded, the track is assigned to separate channels for playback.

3.3.5 Patch

Williams and Webster (2005) defined a patch as “the sequencing term for an individual timbre. Most MIDI devices have a wide assortment of present patches or timbres that can be addressed by MIDI” (p. 355).

3.3.6 Channel

Williams and Webster (2005) stated that a channel is the MIDI language which codes every note with a channel number; a kind of destination label similar to a channel on television. MIDI devices can be set to listen for notes on a specified channel. One MIDI cable can send data to as many as 16 different channels simultaneously. If more channels are required, a second MIDI interface may be needed to bring the number up to 32 channels.
3.3.7 Quantizing or Humanizing

Folkestad (1996) outlined that each of the performance parameters controlled by a sequencer is called an event. Events can include note data, volume, program numbers, and more. Quantizing is a type of mathematical rounding off of the notes to the nearest note value selected. The best way to choose the note value is to select the shortest duration played. Quantizing does have a downside because it can make a musical performance sound mechanical due to the rounded note. Humanizing is the opposite. It can randomly change the start times of notes to make a piece sound as if it is played by a human. Williams and Webster (2005) stated that the concept of quantization is critical for understanding how sequencing works in order to adjust time values to make notes conform to standard grid alignments. Synchronization between audio and MIDI is possible.

3.3.8 Sound Modules

Rudolph (2005) explained that the sound module can only play back sound because it does not have a keyboard controller. The sound modules are smaller because they consist of only the chips to produce sounds, effects, and other timbres. The sound module used in this research study is the Roland Sound Canvas.

3.3.9 Digital Audio Recording

Freeman (2004) stated that the objective of using digital audio recording is to provide integrated digital audio handling within a MIDI sequencing environment, allowing the user to view and edit the two types of information side by side. Williams and Webster (2005) revealed that digital sound structures are used in computers and digital synthesizers in four general forms:
1. Complete sample—a digitized sample made up of a complete segment of music or speech.
2. Single-tone sample—a digitized sample made up of one complete musical tone.
4. Wave-shaping—a more complex digital sound generation where algorithms are used to shape the digital waveform through various combinations of digital oscillators, digital-controlled amplifiers, digital-controlled filters, and digital effects processors. (Webster, 2005, p. 173)

In this research study, students have to edit audio samples and study the use of digital waveform in the sequencing techniques of lecture two in the scheme of work.

3.3.10 Mixer
Freeman (2004) stated that with two or more MIDI devices, there must be a way to control the volume of each unit independently. For this set-up, the audio outputs of each MIDI device are connected to a different channel in the mixer so that each instrument can be equalized using treble, bass, reverberation, and echo controls. Rudolph (2005) suggested that a mixer can route the outputs of a variety of sound-producing devices, such as CD players, DVDs, microphones, and electronic instruments.

3.3.11 Video Capturing and Synchronization with MIDI/Audio Tracks
The sequencing software Sonar 3 provides synchronized playback of a QuickTime or Windows Media player video, with both MIDI and audio tracks in a sequence.
3.4 COMPUTER-ASSISTED COMPOSITION

Reese (2001) argued that “the present use of computers and related technologies in music education are often limited to non-creative skill development” (p. 42). Music technology can expand the horizons of musicality if it fulfills its potential of giving people direct access to creative decision-making with sounds, storage and instant retrieval of those sounds, and devices to alter and refine the previous decisions. This would enable, as Reese describes, “genuine compositional creativity” (p. 43).

Reese (2001) pointed out further benefits of software-based composing:

Students use the software to help them to ‘think’, as they experiment with changes and additions to these beginning patterns or phrases. They can use standard software features of cutting, copying, pasting, and dragging to vary and rearrange these first ideas. The student can easily alter pitches, durations, tempo, tone colours, and volumes. Over time, students gradually refine and organize their ideas into unified, complete pieces of music. (p. 44)

Software-based computing shares similarities with language-writing processes such as brainstorming, drafting, and revising. Software enables an easier entry into composition than paper and pencil by providing direct manipulation of the sound and immediate feedback to the young composer about his or her musical decisions.

The creative process in computer-assisted composition enables students to synthesize earlier learning about musical elements, presents them with interesting problems to solve, and helps them “think in sound” and “feel the expressiveness of their own creative work” (Reese, 2001, p. 45). With repeated experience, problem-solving, and
creative thinking, early limited efforts develop into more complex and satisfying pieces.

From Reese’s perspective, computer-assisted composition, composing, and improvisation are processes that can be put into practice to encourage student-centered learning, creative and critical thinking, problem-solving, working cooperatively with others, and new forms of student assessment. Music technology can change not only “how” to teach and learn but also the “why,” “what,” and “where” of music learning. It can be a catalyst to expand our current music programs into more comprehensive and imaginative experiences that ultimately develop students into active and independent music creators, listeners, and performers.

Writers describing computer-assisted composition have referred to notation software (Purse, 2003; Hollander, 2005), sequencing software (Newquist, 1989; Leong, 1995), accompaniment software (Kersten, 2004), and digital audio recording software (Hollander, 2005), which could be used in an environment where students could work with sound. Although these software programs were originally developed for use by professional and amateur musicians, music educators developed strategies to turn them into potential tools for students to use in composition and improvisation. These programs were most often used with MIDI keyboards but could be used successfully without them. The programs used different modes for students to enter and edit musical ideas.
3.4.1 Notation Software

Purse (2003) discussed the use of notational software in music education. First, he constantly refers to acceptable notation practices in an effort to familiarize users with the art of creating music scores and parts. Then, he introduces the use of keyboard shortcuts to develop habits to improve the accuracy and speed of entering music data. Thirdly, he provides a model for teaching basic music analysis, using the program for learning music rather than just for creating printed music (p. 75). Purse (2003) also provided readers with a way to use the notational software not only as a tool to create music parts and scores, but also as a tool to teach music analysis.

Hollander (2005) claimed that, “Because the user could input data in real or step time from a music keyboard, the use of MIDI in music notation software became very widespread” (p. 3). Once notes were entered into the notation software, the user could add details such as dynamics and articulations. Therefore, scores and parts could be printed and played back when trying out prototypes of compositions and arrangements. The adoption of music notation software into musical education in Hong Kong schools will be discussed further with regard to the New Secondary School Music curriculum and the research findings in the concluding chapter.

3.4.2 Sequencing Software

Newquist (1989) expressed that, “Sequencing in the digital world is what the cassette player is to the analog world” (p. 129), meaning that the way of composing changes from an analog to a digital world in sequencing. This led to the development of sequencing software that made it possible to record and edit separate tracks of music over the 16 MIDI channels. Leong (1995) made the following suggestions for using sequencing software in music education: (1) Students record, manipulate, and play
back any piece of music for immediate conversion to musical notation. (2) Students can make arrangements of pieces or write their own compositions and have immediate feedback on how their pieces sound. (3) Students can experiment with combinations of instrumental timbres. (4) Students can create or improvise a melodic line over a given harmonic background. (5) Students can input a piece and hear the effects of meter changes, tempo changes, and even rhythm alterations (Leong, 1995, p. 58).

Expanding on the suggestions mentioned above, Leong (1995) provided different teaching strategies for using sequencing software in composition in the school music education context. Leong (1995) suggested the use of sequencing software as a tool for composition and improvisation. In this research, the researcher will observe how the students improvise on the MIDI keyboard and compose through the use of music notation. The suggestions are related to the methodology of teaching composition using sequencing software highlighted in chapter 4.

3.4.3 Accompaniment Software
Kersten (2004) reported that “MIDI and other computer technologies can help students build their musical skills in the classroom and at home. MIDI has provided music teachers with increasing opportunities to use quality computer-developed musical accompaniments in teaching music to children” (p. 44). Standard MIDI files are available on diskettes and CDs that are included with music textbooks. Many teachers are now placing MIDI files and home music learning lessons on the web so that students can work and practice at home. In fact, resources on the web are a continual supply of fresh music, teaching materials, and ideas. There are limitations because MIDI presentations may not have the human nuances of musical expressions. However, resources downloaded from the web can provide an inexpensive alternative
to CDs. Teachers can make use of MIDI accompaniments for instrumental solos, choral and solo singing, as well as jazz and classical improvisations for solo instruments.

Kersten (2004) pointed out that “the problem in using CDs and tapes for accompaniments concerns the fixed tempo of these media” (p. 45). There are limitations for students in adjusting the speed and practicing at a slower tempo. By using inexpensive sequencing software, students can change the tempo of the downloaded or self-made standard MIDI files, adapting a composition to their tempo requirements.

The web offers many MIDI sites where specific songs files can be download for free or purchased. As students search the web for MIDI files, they can use a sequencer to generate and modify files. Therefore, students can build their skills in singing, composing, improvising, listening, analyzing, and understanding relationships within compositions, by working with MIDI forms.

3.4.4 Digital Audio Recording Software

Unlike MIDI-based recording, digital audio recording is the process by which sound is digitized, transformed into binary signals, and stored onto a magnetic disk. This technology is the closest replication of the original source of sound described so far. Hollander (2005) suggested that, “Unlike analog recordings, digital audio recordings are easy to edit. A teacher with this type of software can supplement instruction by recording lessons directly to a hard drive, save it to a CD, and then give it to the student” (p. 5). This could also include teachers’ critiquing a student’s assignment produced through the use of digital audio recording, with a final mix between MIDI
and audio, and the final creative product handed in on CD.

3.5 MULTIMEDIA COMPOSITION

Cook (1998) stated that, “Multimedia is to be defined in terms of the perceived interaction of different media” (p. 106). Cook explained the deeper meaning of multimedia as a whole. He used the words emotion and meaning to suggest that sounds, pictures, and words may be aligned with one another on the grounds that they shared emotional properties, and because meaning emerges from such alignments. Cook’s model agrees with Lipscomb (1995), who suggested that there are two implicit judgments made during the perceptual processing of the motion picture experience: an association and a mapping of accent structures (p. 17).

According to Cook (1998), the history of multimedia can be traced back to Ancient Greece. He stated that:

In his Republic, Plato described the relationship between text and music which, historically, is the main source of multimedia theory in terms of the language of conformance: ‘the foot and the melody’. He wrote that it should ‘conform to man’s speech and not the speech to the foot and melody’. The second part of the sentence shows that when Plato says ‘conform’ he means what I have called unitary conformance, and this becomes even clearer when he adds that ‘the harmony and rhythm must follow the words and not the words these’. And unitary conformance has been the dominant model of inter-media relationships ever since. (p. 107)

The history of multimedia could provide the conformance between words and music
in the same way as “the foot and melody.” “The foot and melody” meant that harmony and rhythm must follow the words as an inter-media relationship. Cook further discussed the relationships between the intermedia. He characterized multimedia as something predicated on a distinctive combination of similarities and differences. Therefore, it was logical that the three models should be related through what he called the similarity and difference tests, shown below in Figure 3.1.
In Figure 3.1, the similarity test is based on the distinction in the course of a discussion of metaphors that are clearly related to one another but not identical. The term *coherent* means they are variants but that they fit together. The expressions that are *consistent* are those that coherence allows for differential elaboration, as between the levels of a hierarchy. This means that different media fits together when the similarity test is either coherent or consistent. By contrast, the narrower category of consistency excludes such differential elaboration. Cook (1998) furthered pointed out
that “when considered overall, some multimedia examples fail the similarity test. This will lead to the second test - the difference test” (p. 100). He explained that these relationships are a contradiction. Contradiction implies an element of collision or confrontation between the opposed terms. Words and pictures are generally aligned with one another and they share the same narrative structure, but each medium elaborates on the underlying structure in a different way. The music characteristically introduces connections or connotations of its own, reinforcing the processive structure. These contradictions establish the presence of significant elements of contest. As Cook (1998) states, “The term ‘contest’ is intended to emphasize the sense in which different media are, so to speak, vying for the same terrain, each attempting to impose its own characteristics on the other” (p. 100). Contest lies at the opposite extreme from conformance. Conformance begins with original meaning, whether located within one medium or diffused among all; contest ends in meaning and is intrinsically dynamic and contextual. “The terminology complementation means that pictures, words, and music are each seen as having their own intrinsic properties. In some cases, the result is the conflict between the media and the emergence of a new meaning. For example, the classical Hollywood film was in general virtually complete before it was passed on to the composer for scoring” (Cook, 1998, p. 102).

Cook (1998) concluded that the composer’s job was understood to be one that complemented what was already there in the words and pictures. Therefore, complementation is readily associated with the successive phases of multimedia production. This model could set the principles of the similarity or difference test to align words, pictures, and music in a multimedia setting, in the second task of this study.
3.5.1 Judgment and Alignment of Visual Images and Music

Similar to Cook’s (1998) multimedia model, a model proposed by Lipscomb (1995) implies that there are two implicit judgments made during the perceptual processing of the motion picture experience: an association and a mapping of accent structures (see Figure 3.2). The first, the association judgment, relies on past experience as a basis for determining whether or not the music is appropriate within a given context. For example, a composer may have used legato string lines for romantic scenes, brass fanfares for a majestic quality, or low frequency synthesizer tones for a sense of foreboding. The ability of music to convey such a referential meaning has been explored in great detail by many investigators (Cook, 1998, p. 16).

The second implicit judgment, the mapping of accent structures, consists of matching emphasized points in one perceptual modality with those in another. Lipscomb (1995) proposed that if the associations identified with the musical style were judged appropriately, and the relationship between the aural and visual accent structures were consonant, intentional focus would be maintained.
The model above emphasizes not only the referential aspects of music, but also the hypothesized importance of accent structure alignment between the aural and visual strata in motion picture contexts. There are many examples that illustrate the film composer’s use of periodicity within the musical structure, as a means of heightening the effect of recurrent motion in the visual image. According to Lipscomb (1995), an illustration may be found in John William’s musical soundtrack composed for *ET: The Extraterrestrial*. The score for the bicycle chase scene is replete with examples of successful musical emulations of the dramatic action on-screen. Synchronization of the music with the visual scene is achieved by inserting 3/8 patterns at appropriate points so that the accents of the metrical structure remain aligned with the pedaling motion. From a music cognition perspective, the Lipscomb (1995) study revealed that the alignment between visual images and musical accent was established in film
In the context of the decision-making process proposed by Lipscomb (1995), the music and visual images do not necessarily have to be in perfect synchronization for the composite to be considered appropriately aligned. Like the Gestalt psychologists, Seashore (1967) found that humans seek organization, imposing order upon situations that are open to interpretations according to the principles of good continuation, closure, similarity, proximity, and common fate. In scenes from *ET: The Extraterrestrial*, every rowing or pedaling motion was not perfectly aligned with the musical score. The motion picture’s musical score was probably not observed by the average members of the audience even if their attention was somehow drawn to it.

The significance of Lipscomb’s (1995) model was the suggestion of the alignment of music and visual images in a multimedia setting. The present study explores how the students respond to the visual images and how they use musical elements to treat the alignment musically in order to achieve a multimedia composition with the use of music technology.

### 3.5.2 Film Scoring and Digital Film Scoring

Two different approaches to composing a score in a motion picture soundtrack are illustrated in this section. The first approach is film scoring and the second approach is digital film scoring. Some composers prefer writing with a pencil and paper—film scoring, and some composers would write on a synthesizer and then sequence the music—digital film scoring. This section explores how composers treat visual images musically in multimedia composition. Since different approaches for treating visual images have been well established in film scoring, the composition techniques in film...
scoring are explored to achieve the multimedia task.

In his text on film scoring, Davis (1999) expressed that

successful film scoring is not a matter of just writing good music; it is writing good music that supports a dramatic situation. The most important thing for the beginning composer to learn is how to approach writing this kind of music in finding the heart of the film, the soul of the film and expressing that in music. It can be guided and pointed in a certain direction, either by a teacher, a director, or simply a reaction to a particular scene. (p. 10)

There are several important factors for composers to notice in the creative process:

1. A foundation of craftsmanship and music knowledge.
2. The intention and concept of the scoring.
3. Knowing your own strengths and weaknesses, and your capacity to produce.

(Davis, 1999, p. 141)

These factors are crucial in teaching film scoring to students in order to let them know how to conceptualize a scene as well as how to know their strengths and weaknesses in producing a soundtrack. Davis (1999) provided further three examples to illustrate the functions of the score:

**Example 1**

In *Fly Away Home*, Mark Isham uses a small ensemble featuring a solo viola during much of the first part of the film. As the story develops and becomes more dramatic, so does the size of the orchestra. However, although it is played by groups of different
sizes, the same theme appears throughout. This creates a unity in the music even though the sonority grows in magnitude.

**Example 2**

In *ET: The Extra-Terrestrial*, John Williams presents fragments of a particular theme throughout the film in various different scenes. It is not until the climatic *flying scene* that these fragments come together as a complete musical statement. This is an example of musical development within a plot. The basic musical idea is similar in several situations but the audience doesn’t hear it as a complete idea until the story line is also complete.

**Example 3**

In *Speed*, Mark Mancina uses a combination of several metallic-sounding samples to create an electronic texture. This is used throughout the film as a sound *palette* that mirrors the urgency of the dramatic situation (Davis, 1999, p. 145).

The examples mentioned above illustrate the functions of film scoring. The score can enhance the continuity of the film from scene to scene. The use of different musical elements, for example, pitch, rhythm, texture, orchestration, and thematic and motivic development, are considered. This leads to further discussion on using music technology to compose for computer animation or a motion picture clip, as part of a creative process in multimedia composition.
In digital film scoring, the main advantage of using a sequencer is that it can be faster. A composer can play his ideas, or play along to the video, and it is instantly recorded and notated. Post (2000) implemented a Digital Film Scoring Project at Humboldt State University using a Power Mac G3, Performer 6, a Roland XP-10 synthesizer, and a set of headphones. He tried to offer a basic approach to digital film scoring that did not require a large amount of expensive equipment. It included music sequencing programs, Quick Time movies, instrumentation, and scoring techniques. Scoring techniques included soft hits, hard hits, and calculating hit points (Post, 2000, p. 2).

In order to understand the digital film scoring techniques, Post (2000) stated that the process for calculating a hit point is as follows:

1. Choose your tempo and express it in click track.
2. Convert the timing of the hit from seconds to frames.
3. Divide the timing by the click in frames.
4. To get the total number of beats, add “1” to the number of beat units to account for the first click that occurs while the clock is at zero. (p. 2)

Post (2000) furthered explained that:

When composing the music for the scene, step- or real-time entry or a combination of both may be used. The movie will move forward as you enter notes so you can view exactly what is showing at any given beat of any sequence. (p. 3)
The process for digitally scoring music to film requires skills in critical thinking, musical composition, mathematics, and using computers. Digital film scoring offers students a chance to fine-tune their skills in the areas mentioned above, in order to develop their ability in problem-solving and creativity.

Sussman (2005) trained student composers in digital film scoring at the Manhattan School of Music and explained the basic techniques of scoring to pictures. The use of markers, tempo, meter changes, and intuition to create musical underscoring can support and enhance visual images and dramatic content. For Sussman (2005), the function of a music cue is to support and enhance the visual images and drama taking place on screen. There are some obvious considerations that a film composer must deal with in order to make a music cue work; specifically, a method for converting visual timings or sync points, which are usually given in SMPTE Society of Motion Picture and Television Engineers format, into musical notation format, such as measure, beats, tempo, and meter. To convert timings into musical notation, the creative process suggested by Sussman (2005) is as follows:

1. The spotting session: Meet with the director or producer and get a sense of where the music cue should start and end and what they are looking for in terms of musical styles.

2. Setting the cue: Use the sequencing software to open the music and motion picture file. Try to adjust the SMPTE time code to 1:00:00:00 with Bar 1.

3. Setting up the markers: Open the markers window in the sequencing software. When watching the motion picture frame by frame, you may insert the marker
when it gets close to the sync point. Remember to name the marker and make it recognizable in other windows. Then, you may lock up the markers with the SMPTE time code.

4. Establish basic musical ideas and tempo: Watch the motion picture again and establish some preliminary musical ideas, styles, and tempo for your first cue. (p. 2)

The creative process of digital film scoring is examined in this study. In order to give instructions in the multimedia composition, the technical requirements of digital film scoring are taught to the students before they compose for their project, especially as the student-composers do not have much experience in composing music in a multimedia setting.

3.5.3 Composing for the Media

The literature about composing for media other than film is also valuable in multimedia composition; for example, the literature about composing for radio, TV commercials, or for flash movies on the web. Zager, a Clio Award-winning composer in various media for more than 400 radio and TV commercials, mentions that the musical skills which are advantageous for commercial composers are gained through a knowledge of contemporary popular music as well as traditional, classical, and ethnic music from various cultures (Zager, 2003). Understanding musical history helps composers guide advertising agencies to various styles of music that might work well for their campaign. Certain story lines might reflect a specific time period. If the composer has musical knowledge of different periods, this may inspire valuable
suggestions that help guide the creativity in new directions.

Zager (2003) stated that, “Listening to the radio, CDs in various styles, watching films and television, attending concerts, and studying scores can help the composer become familiar with various music genres and be aware of musical trends and styles” (p. 48). He emphasizes that it is important to pay attention to the timbre of the drums, bass, guitars, unique musical patterns, unusual synthesizer sounds, and other instruments. Also, sounds in contemporary popular musical styles become trends and, in addition to sounds, certain musical patterns can define a style within a time period.

To summarize, the trend of composing for the media has been developing rapidly over the last two decades. Professional composers and academics express their views in composing using different methods such as film scoring and digital film scoring. The problems encountered and the compositional techniques are discussed to lay the foundation for the following study of multimedia composition.

3.6 CREATIVITY

For the purpose of this study, ideas about creativity in the literature were examined: Sternberg’s (1988) view of creativity as a creative person; the creative process outlined by Wallas (1926), Webster (2003), Hickey (2003), and Sloboda (1988); and the creative product as highlighted by Tardif and Sternberg (1988). In the present study, Amabile’s (1996) framework of creativity is adopted because of the linkage between creativity and music composition that has been built into the studies of the creative process in composition. To an extent, Hickey’s creative process model (2003) also adopted Amabile’s componential model in the contexts of music composition and
3.6.1 Amabile’s Framework of Creativity

In the present study, Amabile’s (1996) framework of creativity is adopted because it extended Hickey’s (2003) model of creative process in music composition. Amabile (1996) proposed a framework of creativity that includes three major components: (1) domain-relevant skills, (2) creativity-relevant processes, and (3) task motivation. Domain-relevant skills refer to relevant knowledge about the specific domains, techniques required, and special domain-relevant talent. According to Amabile, these elements depend on innate cognitive abilities, innate perceptual and motor skills, as well as formal and informal education. Furthermore, Amabile claimed that mental imagery may be a good example for illustrating the meaning of domain-relevant talent, as many people appear to possess an extraordinary competence for calling upon visual, auditory, or even kinesthetic images.

Amabile (1996) revealed that creativity-relevant skills and processes include three different elements: (1) a cognitive style characterized by a facility in understanding complexities and ability to break the norm during problem-solving, (2) knowledge of heuristics for generating novel ideas, and (3) a working style that is conducive to creative production. For instance, Amabile (1996) uses the phrase “breaking perceptual sets” to describe the kind of cognitive style in which a subject can see different and alternative uses of an ordinary object. In her view, “suspending judgement” refers to a cognitive style in which divergent thinking is applied in order to search for new and unusual ideas (p. 115). In order to obtain maximum levels of creative ideas, judgments should not be employed at an early stage so that free imagination and association can be encouraged, and creative ideas will be more likely
to appear. This competence refers to how alternative solutions for an existing problem can be explored. A work style conducive to creative production possesses different features, including an ability to concentrate effort and attention for longer periods of time, an ability to abandon unproductive search strategies, a persistence when faced with difficulties, and a high energy level that results in a high level of commitment. Furthermore, personality traits are found to be related to creativity-relevant skills. These traits include a high degree of self-discipline, an ability to delay gratification, tolerance of frustration, independence of judgment, and a willingness to take risk.

Another component of Amabile’s framework is task motivation. This refers to the type of intrinsic motivation generated by the individual’s reaction to intrinsic properties of the task, rather than that generated by extrinsic factors. Task motivation includes two elements: (1) the individual’s baseline attitude towards the task, and (2) the individual’s perceptions of his or her reasons for undertaking the task in a given instance (Amabile, 1996, p. 115). The social environment has a primary influence on creativity by influencing task motivation. For instance, the extrinsic constraints in the social environment may undermine intrinsic motivation, which in turn can be detrimental to the level of creativity (Amabile, 1996, p. 115).

3.6.2 Creativity in Children

Gardner (1982) states that the preschool years are often described as a “golden age of creativity” (p. 88). He observed children participating in a range of artistic activities in the Harvard Zero Project. Children learn to use symbols (ranging from hand gestures to full body movements), pictures, clay figures, numbers, music and the like. By the age of five or six, children cannot only understand these various symbols but can often combine them in ways adults find striking. As children move through the
literary stage, most exhibit a gradual improvement in their ability to understand and to respond to artistic works created by others. Adolescents show sensitivity to those qualities most central to the arts—style, expressiveness, balance, and composition.

According to Gardner (1982)

the U-shaped curve is found in the artistic development of a child. The first part of the U refers to the apparently high level of creativity found among preschoolers. The trough of the U designates the period of literalness, when the child’s artistic creations are less striking in the eyes of many observers. The final part of the U marks a new, higher level of artistic accomplishment. (p. 89)

Gardner (1982) argued that there are clear differences between child and adult artistic activity. While the child may be aware that he is doing things differently from others, he does not fully appreciate the rules and conventions of symbolic realms. Therefore, his adventurous nature holds little significance. In contrast, the adult artist is aware of the norms embraced by others. Her or his willingness and compulsion to reject convention is observed. According to Gardner’s U-shaped curve, the high level of creativity occurs in the preschool and adult years

3.6.3 Creativity in Adults

Through his research, Guildford (1973) explored definitions of creativity and identified 15 characteristics of creative adults: flexibility, fluency, elaboration, tolerance of ambiguity, originality, breadth of interest, sensitivity to problems, curiosity, independent thinking, reflective thinking, the ability to put an idea into action, concentration and persistence, commitment, expression of both the male and
female sides of nature, and a sense of humor. Among all of the 15 traits, four of the traits are the most representative of creativity in adults are (1) flexibility—the competence of turning ideas and materials to new, different, and unusual uses; (2) fluency—the ability to think of many solutions to a problem; (3) elaboration—the competence of working out details of original ideas; and (4) originality—the ability to generate unique ideas that are unusual.

Barron (1988) had a similar perspective on creativity to Guildford. He explained that creativity is “an ability to respond adaptively to the needs for new approaches and new products” (p. 80). The defining properties of these new approaches and products are their originality, aptness, and validity. The creative outcomes are various: they could include an invention, an artistic product, or an answer to a problem. To summarize, creativity can exist in three aspects: in creative people, in a creative process, or in creative products.

3.6.4 Creative People
Characteristics, thinking styles, and personal traits of creative people have been the major focus of research, after which implications for training have been derived. Tardif and Sternberg (1988) suggest that there are three categories to describe a creative person: (1) cognitive characteristics, (2) personality, and (3) motivational qualities. With regard to cognitive characteristics, four traits are related to creative persons: a relatively high intelligence, originality, articulateness and verbal fluency, and a good imagination.

A set of cognitive abilities are processed by creative people: the ability to think metaphorically, flexibility and skill in decision-making, independence of judgment,
coping well with novelty, logical thinking skills, internal visualization, the ability to escape perceptual sets and entrenchment in particular ways of thinking, and being able to find order in chaos. Regarding styles of problem-solving, creative people often possess a preference for non-verbal communication. They often build new structures rather than using existing structures, question norms and assumptions in their domain, are alert to novelty and gaps in knowledge, and use their existing knowledge as a basis for new ideas.

3.7 THE CREATIVE PROCESS IN MUSIC COMPOSITION

The creative process refers to the procedure that a person is involved with when generating a creative product. This procedure may include problem-solving, collecting ideas, generating, selecting and rejecting, and verifying the creative product. Two of the most dominant theories in this area are Wallas’s (1926) four-stage theory and Webster’s (2003) revised model of creative thinking in music. Other researchers of the creative process include Hickey (2003) and Sloboda (1988). The ideas of these four researchers are reviewed in the following sections.

3.7.1 Wallas’s Stage Theory (1926)

The Stage Theory of Wallas (1926) was one of the earliest theories to explore the creative process. According to Wallas, there are four different stages involved in the creative process: preparation, incubation, illumination, and verification. Table 3.1 summarizes the characteristics of these four stages according to Wallas.
<table>
<thead>
<tr>
<th>STAGE</th>
<th>NATURE OF PROCESS</th>
<th>THINKING STYLE</th>
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| 1. Preparation | - Discovering a problem  
- Seeking and collecting data  
- Analyzing and examining data  
- Following rules  
- Association of ideas  
- Trial and error  
- Hard work, otherwise no conception can be achieved in the next stage | - Conscious  
- Logical  
- Systematic |
| 2. Incubation | - Leaving the problem unfinished  
- An interval free from conscious thought  
- Mental relaxation  
- It takes time | - Unconscious |
| 3. Illumination | - A solution for the problem may present itself  
- The culmination of a successful train of associations  
- Less controllable, cannot influence it by a direct effort of will | - Unconscious |
| 4. Verification | - The validity of the idea is tested  
- The idea itself is reduced to an exact form | - Conscious  
- Logical  
- Systematic |

Wallas’s Stage Theory can be applied to a description of the creative process used by a composer. For example, in the first stage of preparation, the composer may discover a musical idea or issue to work on. The composer will then search for and analyze musical works that are similar to the one that he or she would like to compose in addition to thinking about what kinds of composition techniques might be used for the piece. During this stage, the composer has to employ convergent thinking in order to search for the most suitable musical examples and composition techniques. This
involves consciousness in the thinking process in order to test ideas and find solutions. Wallas (1926) explained the flow of the four stages as follows:

In the stage of incubation the composer may have thought consciously for a certain period of time. Perhaps there is a problem that the composer cannot solve; for example, deciding which musical techniques should be used to express specific images or ideas. In such a situation, the composer may leave the musical piece unfinished.

The illumination stage can be the most critical stage in the creative process. After the unconscious incubation stage, a solution to the problem, or a creative idea for the composition, is generated. Nevertheless, the feasibility and the level of creativity is verified by a conscious and objective evaluation process in the verification stage. This takes place when the composer reconsiders the musicality as well as creativity of his or her piece when employing the generated ideas. (pp. 50-53)

These four stages appear to be developmental. However, Wallas (1926) suggests that they constantly overlap with each other when someone is exploring different problems:

An economist reading a Blue Book, a physiologist watching an experiment, or a businessman going through his morning’s letters, may at the same time be “incubating” a problem which he proposed to himself a few days ago, accumulating knowledge in “preparation” for a second problem, and be “verifying” his conclusions for a third problem. (Wallas, 1926, p. 53)
This example reveals that the developmental patterns of different stages in the creative process can be applied in various kinds of disciplines. The overlapping of these four stages may happen when exploring different problems.

### 3.7.2 Webster’s Model of Creative Thinking in Music (2003)

Webster’s (2003) model is designed to be representative of creative thinking by both children and adults, although certain aspects of the model might be qualitatively different at various stages of development. The model is divided into five stages.

1. **Product intentions**: Composition performance, improvisation, and analysis can be considered at the outset of creative thinking as the goals or intentions of the creator.

2. **Enabling skills**: A set of skills that allow for the thinking process to occur. One is convergent thinking skills and the other is divergent thinking skills. Convergent thinking skills are the ability to recognize rhythmic and tonal patterns as well as musical syntax. Divergent, imaginative skills, are critical; for example, musical extensiveness, flexibility, and originality.

3. **Enabling conditions**: A number of variables involved in the creative thinking process that are not musical; for example, motivation keeps the creator on task; personality describes factors such as risk taking, spontaneity, openness, perspicacity, sense of humor, and preferences for complexity; and environment defines the creator’s work conditions such as financial support, family conditions, musical instruments, acoustics, media, societal expectations, and peer pressure.

4. **Working through**: The “working through” aspect is included alongside other steps in the creative process. The notions of revising, editing, and new idea formation might be associated with extension.
5. Creative product: The composition performance, written analysis, recorded improvisations, and mental representations of the music heard.

Fig. 3.3 illustrates the three stages of the creative process in music composition by Webster, which include product intention, thinking process, and creative products.

*Figure 3.3 Model of Creative Thinking in Music (Webster, 2003, p. 21)*

Webster (2003) revised his model of creative thinking in music by considering two important factors: the *revision* and *extension* of the creative work. He suggested that creating a wide variety of timbral effects, spatial distance, and textural diversity can
be carried out easily with technological support. He (2001) recommended that “teachers must design revision activities early and often enough to make this kind of activity a natural part of musical thinking” (p. 245). He claimed that the literature on adult pedagogy for composition is very limited. One can speculate on a staged approach that involves exploration with younger children, the development of craftsmanship with adults, and some sort of expert level that involves students that might be interested in professional work. However, both children and adults need the revision and extension process within the wider creative process.

3.7.3 Hickey’s Model of the Creative Process

Hickey’s (2003) creative process model was based on Amabile’s (1996) model of creativity, relating it specifically to musical creativity involved in music composition. Hickey’s model contains five stages as follows:

1. Task identification—The process begins with identifying the task, which is either self-imposed or imposed by others. The task is affected by the motivation (intrinsic or extrinsic) for the task, type of reward, and task parameters.

2. Preparation—Individuals can either build or recall information for exploring sounds in music and practicing musical ideas, much like the problem-finding activities.

3. Response generation—The response-generation stage is the point when the creator begins to generate possible ideas for the product by experimenting with new ideas, as well as by remembering ideas heard or tried in the past.

4. Response validation—This may include self-validation or responses from a peer or teacher. This is different to the response-generation stage where the process will be most influenced by creativity-relevant skills.
5. Outcome—The final stage is the creative outcome, the musical composition. If successful, the composition may be saved. If there is complete failure, it will be discarded. Some progress toward a successful composition may call for revision, in which case the individual goes back to Stage 1, 2, 3, or 4. (Hickey, 2003, p. 38)

Fig. 3.4 illustrates Hickey’s five stages of the creative process in music composition influenced by task motivation, domain-relevant skills, and creativity-relevant processes as outlined in Amabile’s model.

*Figure 3.4 Hickey’s Model of the Creative Process in Music Composition with an Adaptation of Amabile’s Componential Model of Creativity (Hickey, 2003, p. 39)*
3.7.4 Sloboda’s Model of the Creative Process

Sloboda’s (1988) creative process model used the sketches and manuscripts of professional composers, such as Beethoven, Mozart, and Stravinsky. He summarized his discussion as a diagram of a typical composer’s compositional resources and processes. Figure 3.5 summarizes the typical composer’s compositional resources and processes of Sloboda’s (1988) model under conscious and unconscious elements.

![Diagram of Typical Compositional Resources and Processes (Sloboda, 1988, p. 118)](image)

*Figure 3.5 Diagram of Typical Compositional Resources and Processes (Sloboda, 1988, p. 118)*

In Figure 3.5, the square-edged boxes depict knowledge or structures that are stored in the long-term memory. The curved boxes contain the transitory materials that constitute successive versions of a composition as it grows in the composer’s mind.
According to Sloboda (1988), Box A represents the stage from unconscious inspiration into a conscious idea. Box B represents the linkage between the thematic material and stylistic knowledge. Box C represents the results of applying a compositional technique of transformation and modification to the original theme. Box D represents the modification of the piece until a satisfactory final form is reached. Box E represents the judgment of the original theme in context. Box F represents the tonal center and musical style of the theme. Box G represents the constraints in the overall form and direction. (Sloboda, 1988, p. 117)

From a psychological perspective, the benefit of this study is that it concentrates on the basic underlying properties of the tonal system rather than on the particular compositional forms.

3.8 THE CREATIVE PRODUCT

Creative products refer to many different things in different countries (Tardif & Sternberg, 1988). They can be considered as solutions to problems; responses on creativity tests; explanations of phenomena; technological inventions and artifacts; novel ideas; new styles, designs, and paradigms; fine arts; scientific problem-solving; expressions of emotions and abstract ideas; occupations such as advertising and marketing; and other media (Tardif & Sternberg, 1988, pp. 437-439).

Hayes (1989) investigated the length of time needed for great artists to become masters in their relevant fields. He searched the biographies of 76 composers and 131 painters and found a consistency in the time when these artists had started their professional careers and the time when their first notable masterwork was produced. In defining the first notable masterwork by the composers, Hayes (1989) regarded the
musical piece of the individual composer that had the largest number of recordings. When studying painters, notable works were defined as those works reproduced in at least one of several standard histories of painting. All results implied a “10-year-rule”—even the most noteworthy and talented artists averaged 10 years before they began to produce the work on which their subsequent reputations were built. For example, Hayes (1989) suggested that the early works of Mozart, such as the first four piano concertos, were found to be simply rearrangements of works originally composed by J. C. Bach, and Mozart’s early symphonies were also imitations of Bach’s style.

The position adopted in this research is that creativity is related to the individual and the process. From this perspective, it is the background and prior experience of the creative person as well as the process of generating the creative product that decides whether or not it is creative. Based on the person and process-related perspective, a number of conclusions about creativity can be drawn:

1. Creativity includes the creative products, the creative person, and the creative process. Composition has been undertaken to check the condition and context of the environment.
2. The characteristics of a creative person include the nature of his or her thinking style, cognitive competence, and personal traits.
3. High levels of creativity can be achieved when sufficient time is provided for conscious and convergent thinking as well as unconscious and divergent thinking.
4. Talented artists need a lengthy period of time to acquire the competence to become expert creators.
5. Intrinsic and extrinsic motivations play an important role in determining a
person’s commitment to a creative task, and affect the level of his or her creative product.

6. Creativity is both individually related and process related. The focus for analysis is the process but not the completed product. The differences in creative products are the results of differences in the creative process.

3.9 COMPOSITION AS PROBLEM-SOLVING

From the perspective of cognitive psychology, the concepts of creativity and problem-solving are seen as related. Creative processes are described in terms of problem-solving and the process of problem-solving is described as a chain of creative processes in which decisions are made. The general view of cognitive psychology is that all problem-solving is carried out in the same way, involving the same steps and operations, almost regardless of the content and context of the problem. The problem-solving approach is generally well established in music (Sloboda, 1988; Gardner, 1983; Webster, 1988, 1990) and for investigating composition (Davidson & Welsh, 1988; Scripp, Meyard, & Davidson, 1988; Webster 1992) as “one might expect to find strategies in musical composition similar to those reported in studies of general problem-solving” (Davidson & Welsh, 1988, p. 263). The present study is based on a problem-solving approach. The presentation of the creative process of a student’s composition is a problem-solving task used to clarify the similarities and differences between individuals.

Scripp (1988) established that adults in general succeeded better in solving a composition task than children, and these results were interpreted as “powerful evidence of musical development without musical training” (p. 87). However, if the
task is to find the right sound or drum pattern to a hip-hop tune, the result would probably be the reverse of the original study, with the children being more successful than the adults. In fact, the only relevance that can be drawn from such investigations is an understanding of how the participants succeed in solving a particular task in a particular situation within a particular musical style.

Berkley (2004) extended the composition as problem-solving into the composition pedagogy. She noted the importance of an understanding of composing as problem solving in a student’s capacity to perceive the problem structure, to search for a musical form as the student’s compose, and in their capacity to sense musical possibilities. From Berkley’s (2004) findings, by conceptualizing composition as problem-solving as the composition pedagogy, the students developed skills and knowledge in problem finding, hypothesising, applying the conventions of the style and idiom and perceiving answer as series of interrelated problems. Furthermore, students’ personal development indicated an increase in ownership, autonomy and authority. In the present study, students come to understand the total composing problems comprises interrelated problems with multiple potential answers which require the students to combine systematic application of different musical elements and compositional techniques. Students use skills of hypothesis (musical ideas and imagination) and verification (sequencing software) to explore, predict and test potential solutions as the students compose in these two different composition tasks by using music technology.
3.9.1 Composing Strategies

The composing strategy of the student somehow reflects the decision-making during the creative process. Composing strategy research by Paynter (2000), Hogg (1993), and Burnard (1995) refers to recent research studies about how music technology affects the student’s decision-making during the creative process.

Paynter (2000) defined music composition as “the most natural thing for human beings to make up music” (p. 6). When students compose, they are not concerned with things such as “structure and form.” Instead, they are simply responding imaginatively to a stimulus. They like the sounds they discover; they enjoy playing with them and making patterns. They can fashion little musical pictures to represent incidents, animals, or whatever. It is a matter of feelings and emotions. Even renowned composers, for example Ravel, appear to have supported that view in pointing out that “sensitivity and emotion are the real content of a work of art” (Paynter, 2000, p. 7).

Paynter (2000) described the creative process as “progressive” so that we feel the energy and forward drive of the music; others are “recessive” in effect, the music calming or becoming quieter or slower until it seems to stop of its own accord. These are the result of decision-making. The decisions are not necessarily conscious, but they are decisions nevertheless, taken by whoever creates the music. He concluded that
the surest way to help students to be better at composing is to encourage them to think about the essentially musical process not as abstract rules, but directly in relation to what they themselves create. Composing is different. From the start, students must try to judge the success of what they make. Their composing decisions are vitally important. (pp. 7-8)

This implies that the creative process of composition is to observe what the student has created and make a judgment on what he or she makes, rather than to be seen as a set of abstract rules to follow.

Paynter (2000) defined the word “composing” as meaning positioning things together, and as occurring when someone who has tried putting sounds together is sufficiently pleased with the results to remember them. Then the instructor can start to teach mainly by asking questions about what is presented. It is important to comment on what we hear rather than on what we see notated (p. 8).

Paynter (2000) also referred to the intention of the composer:

A composer’s intention is part of the context: the starting point, stimulus, and inspiration. This may be literary, historical, political, sociological, topological or even zoological as with Saint-Sean’s Carnival of Animals. It may be a musical procedure, for example, fugue or the sonata principle - or a stylistic convention, such as Stravinsky’s neo-classicism in Pulcinella, it is merely the context from which the composer starts to think about making a piece. (p. 9)
Therefore, the word *context* is premusical, and although it might be described as “an idea for music”, it is not the same as a musical idea. A *musical idea* may be applied to a melody or motif or musical elements. The word *form* is used indiscriminately for what is notated as well as what is perceived to belong to an abstract schema—ternary, rondo, sonata—irrespective of any musical reality. Paynter (2000) explained that the word *idea* is the outcome of thinking about and around *context*. It is entirely musical and may be a sudden revelation: a feeling for the completed piece and what the whole thing will be like (p. 11). The definition such as “context,” “form,” and “musical idea” by Paynter (2000) will be adopted in this research.

Hogg (1993) suggested 16 strategies to assist students of composition. It is acknowledged that whether teachers have a music-as-knowledge or music-as-accomplishment focus, they might well enhance their teaching by adopting the following guidelines:

1. Provide ongoing opportunities for students to compose,
2. Ensure that every task has the potential for a musical outcome,
3. Keep the task simple, and
4. Allow students to work in friendship groups.
5. Allow exceptional students to work on their own.
6. Set clear boundaries.
7. Review progress regularly.
8. Learn to ask questions rather than provide solutions.
9. Allow sufficient time for students to bring their own ideas to fruition.
10. Do not worry when some of the students go off-task.
11. Expect that each group will perform, but do not insist.

12. Let each new task emerge from the previous one.

13. If the product is unmusical, question the process.

14. Learn to trust the students.

15. Keep the groups small.

16. Reflect on values and work practices. (p. 10)

These 16 strategies are adopted in part of this research to design the teaching and learning process of computer-assisted composition and multimedia composition tasks. For example, “Keep the task simple” and “Let each new task emerge from the previous one” are used to set the task in this research study. “Review progress regularly” and “Reflect on values and work practices” are used to check the process of composing in the student’s journal. “Allow sufficient time for students to bring their own ideas to fruition” and “Allow exceptional students to work on their own” are used to give sufficient time for students to compose with music technology in the laboratory or at home on an individual basis.

Burnard (1995) has documented the results of another important research study in which she studied Year 11 students (15-16 years old) who could read and write musical notation, and who were actively involved in instrumental or vocal tuition and participating actively in at least two performing groups in their school. Burnard’s main purpose was to explain how different task designs impact on senior secondary students’ ability to compose. Her study was undertaken over four terms of coursework during which the researcher acted as the teacher. Data gathered included the collection of compositions, diaries, and reflective journals in which the students explained their
composition process and their reflection, as well as information on the subjects’ music backgrounds and attitudes and approaches to composition from three surveys.

Four types of composition task were used in order to provide a series of different levels of constraints and freedom. Burnard’s prescription task involved a high degree of control, in which students were given specific instructions on instrumentation, genre, length of the work, formal structures, and tonal structures. The choice task incorporated two different types of activities. The first offered a less specific range of options with only one constraint—an ethnic piece of a non-Western style; whereas the second required students to compose for an instrumental ensemble using either a set of variations on a given tune, a piece in rondo form. The freedom task was the fourth type of task, which provided a totally open-ended composition for voices (Burnard, 1995, p. 32). Therefore, the method of analyzing the data in this study focused mainly on the execution of task requirements (what was done), reflection on students’ experiences (why), and approaches to composing (how it was done).

According to Burnard (1995), time spent on tasks varied between different tasks and different creators. Free tasks generally took longer for students to complete. There was a tendency for students with less confidence but similar musical backgrounds to spend less time on the creative tasks. In contrast, students who displayed more confidence tended to spend more time on their compositions. Consequently, the results suggest a relationship between the students’ confidence and commitment to the task, and the length of time they spend completing their compositions. Students were asked to provide a single word to describe their feeling at the completion of each task. The results indicated that students generally provided varying responses to how they
felt they were doing as they worked their way through their compositions, but were usually more resolute and positive by the time they had completed each composition (Burnard, 1995, p. 34).

As far as activities engaged in composition are concerned, the students’ composing behaviour is recorded and compared in the present study. In general, Burnard’s (1995) study suggests that students rarely refine the final forms of their composition. By contrast, listening was most commonly found to be an independent learning activity. Individuality in artistic creation is important in composition and it was concluded that music teachers should design different tasks according to their students’ interests and needs. In the present study, the composition is task oriented; Burnard’s (1995) study showed clearly that different types of tasks are incorporated in the creative process of composition.

3.9.2 Improvisation and Composition

The differences in views of composition and improvisation are discussed in this section. The use of improvisation and composition are incorporated in the creative process of computer-assisted and multimedia composition tasks.

Schon (1983) described jazz improvisation as an example of reflection in action. The reflection is done simultaneously as one is playing, and reflection is thus integrated into the activity of playing. Following the same path, composition can be described as a reflection on action. The musical material in a composition that emerged from an improvisation is listened to and evaluated, and a decision is made about what to reject,
correct, or accept. Therefore, composition can be defined as improvisation plus reflection. This method of creating music has been practiced by music makers within genres of oral tradition, for example jazz musicians who recorded several improvisations and versions of the same tune, and afterwards have decided which of the takes is to be released on a record. In reflection on action, after listening to the various takes, one of the improvisations is defined as the composition (Jones, 1992). By using music technology and MIDI equipment, this way of working has been considerably refined and new ways of creating music have consequently been developed.

Another feature in describing the distinction between improvisation and composition is the time factor. Improvisation is always carried out in real time. Composition can be stopped at any time. Therefore, improvisation is done in present time and only exists together with its creator. However, composition is a product that can be separated from its creator and performed without the presence of the creator. In the study of composition by Swanwick and Tillman (1986), the authors provide the following definition:

We define “composition” very broadly and include the briefest utterances as well as more worked out and sustained invention. Composition takes place when there is a freedom to choose the ordering of music, without notational or other forms of detailed performance instruction. Others may prefer to use the term improvisation, invention or “creative music”. All these fall within our definition of “composition”. (p. 311)

Swanwick (1988) provided a broader definition of composition that included all kinds
of musical experiences like improvisation and invention. In this study, the collected data cover musical material from the musical performance, improvisation, and composition when computerized tools are used in the process of computer-assisted and multimedia composition. The definition of what is regarded as a composition is related to the definition of Swanwick (1988). In fact, the use of improvisation is recorded and saved in the MIDI file during the creative process.

3.9.3 Style, Genre, and Musical Language

These two concepts, style and genre, have already been used in this research during the creative process of composition. Although the concepts are sometimes used interchangeably in our everyday life, the distinction between style and genre is as follows. Style is the music related to its musical context, a description and classification strictly based on its musical features. Genre is the music related to its function in a social context (Olsson, 1993). For example, “Punk” as a musical style can be described as a heavy fast beat, noisy guitars, and aggressive vocals. “Punk” as a genre can be described as safety pins in the cheek, an extremely distinctive hairstyle, and rebellion against the adult world.

Style and genre are related to the function of music. In style, the aesthetic function and features are emphasized. In genre, the social function of music is emphasized. Olsson (1993) pointed out that the tradition of classical music has emphasized the aesthetic function, picturing music as art, while popular music as rock and punk have emphasized the social function. Definitions of musical style are often centered around formal and external observational features of how the music is organized (Ruud, 1992). Ruud (1992) stated that “such a traditional understanding of the concept of
style leads the researcher to search for the patterns in the musical parameters” (p. 76). Therefore, the definition of style includes many of the features of what is described above as genre.

In studying both classical and popular music, the mastering of musical language is essential. Since this study is undertaken in Hong Kong, a melting pot of Eastern and Western cultures, *bimusical* plays an important role in studying the creative process of the students’ compositions. From the perspective of ethnomusicology, Hood (1960) defined the term *bimusical* as deep knowledge of the music culture of one’s own and of a foreign music culture. Today there is a plurality of musical styles and genres existing and mutually stimulating and changing one another. Instead of being bimusical, most young people today are *multimusical*. They master a plurality of musical languages with the ability to switch between them. Therefore, the mixture of different musical styles and genres may be found in the creative process of students’ compositions.

3.10 RESEARCH IN COMPOSITION

Studies of composition may be divided into two groups: the first group is comprised of investigations into children’s composition and the second group is comprised of investigations into the professional composer’s compositions. The developmental perspective is taken in this study to examine the creative processes of composition among students. Swanwick (1988) suggested that research on musical growth reveals developmental sequences across ages. While the content of that research may vary, the importance of knowing about developmental sequences is articulated by a range of different writers. Hargreaves (1986) supported the idea of developing, implementing, and evaluating music education curricula based on theories and techniques found in
developmental psychology. Music educators need to focus on the “sequential changes in the psychological structure of the individual as he interacts with music” (Zimmerman, 1981, p. 50). The importance of knowing when and how children and adults learn can guide thinking in the teaching sequence and selections of appropriate materials.

3.10.1 Swanwick’s (1994) Model of Musical Development in Children’s and Adults’ Compositions

Swanwick (1994) refers to the underlying theory of musical knowledge. The implications of his study go beyond the specific activity of children composing, an activity in schools not so easily found in many other parts of the world. He chooses to investigate composing because any insights in this area greatly illuminate how people are thinking musically. *Composing* in this context is defined very broadly and includes the briefest spontaneous utterances as well as more sustained and rehearsed invention and takes place when there is some freedom to choose the temporal ordering of music, with or without notational and other forms of performance instruction. (p. 85)

Swanwick (1994) suggested four layers of musical knowledge that eventually came to be seen as encompassing a polarity between *assimilatory* and *accommodatory* tendencies. The growth of all understanding depends on two complementary and interactive processes: being able to relate experiential data to our internal systems of meaning (assimilating to our schemata), but also being able to modify these systems when they cease to be adequate to interpret experience and sustain coherence (accommodation). Musical knowledge is no exception, and observing and
participating in the music making of children offers us further insights into structures and processes (see Figure 3.6).

![Figure 3.6 Model of Musical Thinking: The Left and Right of the Spiral (Swanwick, 1994, p. 87)](image)

Swanwick (1994) points out that the essence of these developmental elements can be captured in short criterion descriptions which characterize their essential differences:

**Level 1—Sensory:** There is evidence of pleasure in sound itself, particularly timbre and extremes of loud and soft. There are many ways of exploration and experimentation with instruments.
Level 2—Manipulative: The handling of instruments shows that some control and repetitions are possible, such as glissando, scale and interval patterns, trills, and tremolo. Compositions tend to be long and repetitive because the composer enjoys the feeling of managing the instrument.

Level 3—Personal expressiveness: Expressiveness is apparent in changes of speed and loudness levels. There is drama, mood, or atmosphere, perhaps with reference to an external “programmatic” idea.

Level 4—The vernacular: Patterns appear: melodic and rhythmic figures that are able to be repeated. Pieces may be quite short and will work within established general musical conventions. Melodic phrases may fall into standard 2, 4, or 8 bar units. Metrical organization is common along with such devices as syncopation, melodic and rhythmic ostinato, and sequences.

Level 5—The speculative: Compositions go beyond the deliberate repetition of patterns. Deviations and surprises occur, though perhaps not fully integrated into the piece. There is expressive characterization that is subject to experimentation, exploring structural possibilities, and seeking to contrast or vary established musical ideas.

Level 6—The idiomatic: Structural surprises are integrated into a recognizable style. Contrast and variation take place on the basis of emulated models and clear idiomatic practices, frequently, though not always, drawn from popular musical traditions.
Level 7—The symbolic: Technical mastery serves musical communication. Particular groups of timbres, turns of phrase, and harmonic progressions may be developed and given sustained concern. There is a strong sense of personal commitment.

Level 8—The systematic: Beyond the qualities of the previous level, works may be based on sets of newly generated musical materials, such as scales and note rows, novel systems of harmonic generation, electronically created sounds, or computer technology. (pp. 88-89)

The implication of the spiral model for this research is to observe how each stage of musical development develops in music composition. The musical activities start as a personal activity and develop into a social activity. It might be natural to draw such a conclusion by studying formal music education, in which playing an instrument is often learned as a personal activity, and later, when a certain level of skillful and technical control of the instrument is reached, expands to playing with others in different ensembles, a social activity. However, there are alternative ways of interpreting the results of Swanwick and Tillman (1994). The modes are accumulated instead of appearing in a developmental chain or spiral (Hargreaves, 1992, p. 3). The more advanced stages enrich rather than replace earlier stages, “just as even though we now can walk upright, we retain our ability to crawl” (Davidson & Scripp, 1989, p. 63).

In this study, musical development can appear in context-dependent areas at the same
time. For example, when doing an unfamiliar musical activity on a familiar instrument in an unknown musical style, the activity has to be trained from the beginning. Hargreaves (1992) found that novices seemed to start from the beginning when doing jazz improvisation on the piano although they had reached a fairly high level in classical piano playing.

3.10.2 Kratus’s (1985) Model of Compositional Development in Children

Kratus (1985) conducted a study that examined original compositions created by 80 children aged 5 to 13. From a developmental perspective, Kratus was interested in any trends that might have emerged. The students were asked individually to create a song that was pleasing to them. The melody was to be created within 10-12 minutes, involving only the white keys of a small keyboard, and beginning with the notes C, D, and E. Several trends emerged as a result of his analysis. In terms of melodic material, children under five or six have no concern for predictable patterns or overall structures of cohesiveness, while after these ages, predictability of these patterns increases. There is increased use of melodic motives between 5 and 11 years of age. These motives receive more attention in terms of musical development from children who are approaching 11 years of age.

The interaction of rhythmic material reflects what was found with the melodic material in terms of predictable patterns, overall structures of cohesiveness, and use of motives. The difference, however, is that the development of rhythmic motives remains relatively static and unchanged at all ages. Metrically, children aged 6 to 10 consistently incorporate changing or mixed meter in their creations. Regularities begin to occur after the age of 10, in terms of how the mixed meters are integrated.
The findings of the application of Kratus’s (1985) model suggested that there are “developmental differences in children’s strategies for composing music” (p. 17), and as children grow from age 7 to 11, “development and repetition become more prevalent compositional processes” (p. 7). The creative act of composition for the 7-year-olds was very similar to the act of improvisation, whereas the 9 and 11-year-olds used significantly more development and significantly less exploration, and 11-year-olds used significantly more repetition than the 7-year-olds did. Kratus’s (1985) study emphasized the differences between ages in the creative process of music composition, whereas the current study emphasizes the use of music technology with the presence and absence of visual images.

3.10.3 Bennett’s Model of Compositional Development in Professional Composers

By interviewing eight professional composers, Bennett (1976) developed a model of the process of musical composition. The germinal idea is the initial phase of musical composition as it provides the inspiration or idea for the work. This first phase is viewed as central to the composing process and involves both external and internal events. For example, external events include environmental occurrences such as sunset, another work or art, and improvisation in response to other sounds, while internal events include emotional states of consciousness.

The sketch phase involves the transfer of a germinal idea to a visual and more permanent form, preserving it for later use. Frequently the sketch directly leads to the
next phase—the final draft. It is important to note that the process may flow between first draft, sketches, and germinal ideas, leading to an additional first draft for more new material. The elaboration and refinement phases involve the working and reworking of germinal ideas. This results in a final draft and copying of the score, which is sometimes followed by a revision phase. The importance attached to the optional revision depends on the composer after the performance of the work. The abstract and concrete representation of musical ideas and intuitive operations are evident in this model. The germinal idea phase is primarily spontaneous and intuitive, while the first draft, elaboration and refinement, and revision phases are significantly more logical and rational.

The fostering of experiences in music composition carries important educational considerations. Developing germinal and internal musical ideas relies heavily on long-term memory and past experience. Thus, students cannot be expected to compose in a style or medium that is unfamiliar. The entire process suggests that students must be made conscious of the various aspects and operations inherent in producing a creative product. Students will need guidance and practice in monitoring their own creative musical behaviour. This means that they must have the opportunity to hear their compositions in both draft and final form. Composition as a thinking process provides learners with a means of applying a wide variety of cognitive operations toward musical conceptual and skill areas.
The implication of Bennett’s (1976) model for this research is that even professional composers encounter different phases in the creative process of their compositions. The growth of musical ideas from germination to elaboration and refinement matches the findings of Sloboda’s (1988) model regarding the creative process changing from unconscious to conscious, from the cognitive psychology perspective.

From the developmental perspectives in studying music composition, Swanwick
(1988) suggested research on musical growth reveals developmental sequences across ages. Hargreaves (1986) supported the idea of developing, implementing, and evaluating music education curricula based on theories and techniques found in developmental psychology. Kratus (1985) conducted a study that examined original compositions created by 80 children aged 5 to 13. From a developmental perspective, Kratus was interested in any trends that might have emerged. Bennett (1976) developed his model of the process of musical composition in professional composers. All these studies reveal that musical growth involves a developmental pattern in music education and music composition. This will be further extended to discuss how music technology enhances creativity and musical thinking from a developmental perspective through the creative process of the students’ compositions.

3.11 STUDYING COMPOSITION USING A COMPUTER

In 1977, long before the current music technology was developed, one of the first studies using computers to investigate the composition process was carried out by Jeanne Bamberger, who “experimented with a computer-based composition system as a means for studying decision-making processes in melody writing (Webster, 1992, p. 274). Since then, an increasing interest in the use of computers and music technology as a means of exploring musical composition has resulted in several studies in this area. Webster (1990) suggested that when researchers observe children creating, and then attempt to analyze and report what happens when the children create, they are revealing patterns of thinking and behavior that can be studied. By asking children to solve
musical problems with the goal of creating a musical product, we have an opportunity to learn more about the creative process while at the same time engaging children in tasks that are fundamental to music as art. (p. 28)

These kinds of research are central to unraveling the mystery of how children compose. Swanwick (1988) stated that “observing children’s more spontaneous musical behaviour is likely to tell us much more than the more limited activities of testing will allow” (p. 54). He suggested that the most direct and uncomplicated way to extend developmental studies in school age students is through the observation of children’s musical compositions: “Composition takes place when there is some freedom to choose the ordering of music, with or without notational or other forms of detailed performance instruction” (p. 60). Therefore, studies in composition by means of a computer are crucial and necessary in conducting research from the 1970s to the present.

Bamberger (1977) was interested in the decision-making processes that occurred while writing melodies. Specifically, he was interested in the creation and growth of students’ mental representations as they wrote melodies. Recruiting two untrained college students, Bamberger asked them to write melodies through a computer-based composition. The system allowed the students to maneuver five tune blocks until a melody with which they were pleased resulted. Data in the form of observations and think-aloud protocols enabled Bamberger to provide rich descriptions and analysis of what occurred. Each student approached the task in different ways. One explored cautiously while evaluating the possibilities, and the other explored freely. Another difference was the ability to think in sound, as shown through the use or non-use of the keyboard. The differences between the two students in terms of the approach and
construction of the melodies shed light on the musical features, abilities, and mental representations of each.


Kozerski (1988) found that the effects of interactive participation with computers in compositional activities offered a better paradigm than present music education software, which is primarily built around a drill and practice format that is neither stimulating nor necessary. This study implied that, rather than the use of software for presentation, it is the interaction between the student and music technology which is crucial.

The use of music notation software was emphasized in two other studies. Conant (1988) found that the use of computer-generated notational software by fifth- and sixth-grade students in writing their own melodies, harmonizing them, and developing a rhythmic accompaniment facilitated the learning of music fundamentals; creative revision; and aural recognition of texture, melody, and contour. Upitis (1989) described the application of computer software to creative compositional activities with children, emphasizing the creation of notational systems and the use of
traditional notational software.

Scripp, Meyaard, and Davidson (1988) found a significant difference between adults’ and children’s abilities to harmonize a known melody. The technology enhanced the success of the adults’ product in terms of harmonic sense, voice independence, and contrapuntal syntax. These products were then compared with those of trained conservatory students. When products involving simple composition tasks were compared, little difference was found. When products involving more difficult composition tasks were compared, differences were revealed. The trained conservatory students were more successful in finding solutions to the problems than were the untrained adults. After the untrained adults were exposed to various problems, their ability to complete the task and handle a new level of musical problem-solving increased. There was also a difference between the untrained adults and the trained conservatory students in terms of the interaction with the computer. The latter group had less need to constantly monitor what they were producing. The researcher stated that, “The process of composing with notation appears to be highly internalized (less dependent on monitoring) for trained musicians” (Scripp, Meyaard, & Davidson, 1988, p. 87).

Younker and Smith (1992) replicated and extended previous research by Scripp, Meyaard, and Davidson (1988) in music education, composition, and cognition by presenting a qualitative analysis of the structure of verbal protocols and music productions collected during a melodic task. This study was devised out of a concern for understanding the structure of musical thoughts while composing, and the application of this understanding to build composition programs for school music education programs. Four subjects were selected for participation, each reflecting a
specific population as determined by responses to a survey. They represented an adult expert, an adult novice, a high school expert, and a high school novice. Data were collected from a sequencing program, taped collections of verbal and sung protocols, and musical compositions. Both processes and products were examined qualitatively. The analyses of the data resulted in both a general input-output model, as well as a more specific information-processing model that described the thought processing structure of the adult expert. The results revealed that there may be a hierarchy of knowledge necessary for expert-level attainment.

The perspective changed significantly from studying music notation software in the 1980s to investigating participants’ composing behaviour in the 1990s. Ladanyi (1995) used a qualitative case-study approach to examine the compositional thought processes of four high school students. A computer and MIDI keyboard were used, together with a music notation program. One of her major findings was that there are four classifications of novice composers at this level:

1. Archetypal—processing the “gift” of imaginative ideas, but without much experience and knowledge;
2. Style emulator—strongly influenced by popular genres with few original ideas of their own;
3. Technician—students who seem to concentrate on surface details without connecting to deeper musical meaning; and
4. Super composer—students with the “gift” and with past training and experience to achieve a high level of attainment.

Ladanyi (1995) observed that the technology allowed a balance between structure and freedom, and allowed each student to construct his or her own effective learning with only modest teacher/researcher intervention.
After the 1980s, the use of music technology to reduce reliance on performance skills and staff notation was further examined in the mid-1990s. Reese (1995) explored music technology in education. Music technology can reduce the need for advanced performance skills and higher-level use of staff notation. Folkestad (1996) examined the process of creation for 129 pieces by 14- to 16-year-olds over a three-year period in Sweden. MIDI files (887 in all) were collected during the process of composition, and interviews and the observations of participants were recorded. From the data, Folkestad produced a typology for compositional strategies. The two principal types were labeled horizontal and vertical. Horizontal composers worked at the start with a conception of the piece from the beginning to the end. They tended to complete one line at a time. Some composers worked exclusively on the computer and others would opt to use an acoustic instrument, such as the guitar, to work out ideas before entering them into the computer. Vertical composers worked on parts of the whole at the same time, completing one part before moving on to the next vertical space. They had an idea of the overall musical form ahead of time and defined each line of the vertical space from the start. This research is useful because it resulted in a model that other researchers can use to investigate children of other ages, or with other media.

MacInnis (1996) undertook a qualitative study of three high school students, adopting an autoethnographic approach that used composing with computers and journaling. Rather than organizing her results according to traditional concepts of music elements, MacInnis allowed the students’ interaction with the technology to define 38 different exemplars of music experience.

Stevens (1996) pointed out the close relationship between music technology and
music education, arguing that “the computer may be used as a highly versatile tool by both adults and children to compose music in many different styles” (p. 15). There are many software programs that may be selected to match the user’s musical abilities and skill levels. Some programs represent music through “graphic notations and colours rather than through the traditional method of notes on the staff. These are particularly suitable for young children to work with” (p. 16).

Younker (1997) used technology in an imaginative way to offer a platform for composition that allowed for the analysis of thought processes and strategies of children of different ages. Students were asked to think aloud while composing at the computer and to respond to questions in an unstructured fashion. Data revealed differences in thought processes and strategies that could serve as the basis for a developmental model.

Nelson (1998) used the composition and orchestration capabilities of the computer to extend a general music curriculum in secondary schools. This curriculum built on the music learning theory model to include experience with timbre variation as well as to reinforce melodic and rhythmic contents. It was concluded that the computer and synthesizer were effective adjuncts to the general music curriculum.

Mills and Murray (2000) evaluated the use of music technology in education at secondary school level in the United Kingdom. They pointed out that a year nine student at high school hums the melody along with the bass and chords in a songwriting project. Students who do not have keyboard skills prefer to use step time to record their performance, and students who have better keyboard skills prefer to use real time to record the notes in the sequencing software. Also, digital audio
recorders can facilitate the songwriting process by increasing the tempo of a recording without affecting the pitch or timbre. Multitrack recorders are often the best tools offered to more competent performers.

In his research into composition using music technology, Webster (2001) included a major component not only for capturing data or as a medium but also as a focus of the research itself over the past 10 years. It revealed that music technology was not only used as a tool for composing, but also as a tool for researching into the creative process, composing behaviour, and composing strategies.

Jennings (2003) presented the research findings in Hyperscore and Hyperinstruments, which were developed by a composer and researcher, Tod Machover, from the Massachusetts Institute of Technology (MIT) as an international music technology project for children. Jennings (2003) defined Hyperscore as a “graphical computer-assisted composition system for users with limited or no musical training [which] takes freehand drawing as input, letting users literally sketch their pieces” (p. 4), and Hyperinstruments as a “complementary approach [which] consists of the design of non-standard physical interfaces which may act as controllers for synthesizers, such as Beatbugs and Music Shapers” (p. 2). With the Hyperscore software, users can position the musical projects anywhere on the canvas and can view four different levels of zoom for ease of editing on the screen. The first step in composing a piece is creating some melodic material in a motive window. The window’s vertical axis represents pitch spanning two octaves while the horizontal axis represents time. Users can stretch or shorten the window depending on how long the motive is. This software is particularly designed to facilitate composition by users who have little or no musical training. The representation of graphic notation replaces
the traditional music notation system in this research.

Savage (2005) suggested the use of sound design in composition with software *Sound2picture*. He documented the work of two electroacoustic composers who demonstrated a sound design process. “The compositional process drawn from the work of electroacoustic composers included six steps as follows: 1. thinking in pictures 2. choosing the colour palette 3. the source: choosing the overall sounds 4. the visual cue: choosing specific sounds 5. additional elements and 6. the final mix” (p. 337). Savage (2005) recommended that the use of sound design can be integrated into the music education curriculum in music composition and music technology context.

Crow (2006) explored the position of music technology in relation to musical creativity. He mentioned that “creativity in music education is generally believe a good thing. However, it does not always engage or motivate students” (p.121). Crow used softwares such as *DJ remix software*, *loop-based sequencers* and *musical accompaniment generators*. These softwares did not require traditional musical skills or conceptual understanding. The software was attractivey presented as a set of creative tools, which offered a range of musical choices. The choices were drawn from banks of readymade musical material, which could be controlled in a variety of ways. Crow (2006) found that the software could engage the students into active learning by doing a three minute track using the *DJ remix*. However, the music teachers need to rethink, redesign, develop and resource a new music curriculum that may include the engaging manner with music technology for the students.

The trends from 1970 to the present in studying composition using computers have
been outlined. In Bamberger’s (1977) study, decision-making was emphasized in the compositional process. From 1980 to 1990, most of the research studies, such as Kozerski (1988), Conant (1988), Scripp, Meyaard, and Davidson (1988), and Younker and Smith (1992), focused on the music notation software and composition of both adults and children. From 1990 to 1995, there was a change of perspective from music notation and music composition to studies of the compositional process and participants’ composing behaviour, such as Ladanyi (1995), Reese (1995), and Folkestad (1996).

MacInnis (1996), Nelson (1998), and Stevens (1996) developed research into composition with studies of musical elements, musical styles, and orchestration capabilities. Younker (1997) used music technology to analyze thought processes and composing strategies in composition. Composing strategies became the trend in the study of composition between 1995 and 2000, including the studies in composition by Burnard (1995) and Paynter (2000). From 2000 onwards, Mills and Murray (2000) extended the use of music technology into songwriting and arranging projects. In 2001, Webster concluded his research into composition using music technology and established music technology not only as a tool to compose with, but also as a tool to capture data with which to study the creative process of music composition. Jennings (2003), Savage (2005), Crow (2006) extended the research of music technology into developing new MIDI controllers, sound design hardware and software, and how the music technology fits into the new music curriculum in both school and tertiary level.
3.12 IMPLICATIONS FOR THE PRESENT STUDY

From the above-mentioned studies, the creative processes and strategies that developed while composing with music technology influenced the focus of the present study. The desire to have students compose with as few limitations as possible in Task One, and to give them a musical problem to solve with the aid of a visual stimulus in Task Two, crystallized after reviewing the literature on certain subjects: music technology, composing for the media, the creative process and product, composing strategies, and developmental perspectives in music composition. An attempt was made to provide an environment with computer music workstations in which students had time, in multiple sessions, to explore, define, and shape two different types of composition.

For this chapter, the literature was divided into four areas of study. The first section included music technology, computer-assisted composition, and multimedia composition. The second section dealt with creativity, the creative person, the creative process, and the creative product. The third section covered composition as problem-solving, composing strategies, improvisation and composition, style, genre, and musical languages. The fourth section included research in composition and studying composition by means of computers.

In the first section, an overview of music technology was presented. The definitions and functions of music technology were explained. Reese’s (2001) definition of computer-assisted composition was outlined; this includes four types of software: notation, sequencing, accompaniment, and digital audio recording. Multimedia composition as defined by Cook (1998) was presented and the influence of visual images on music as described by Lipscomb (1995) was outlined. Film scoring and
digital film scoring, as described by Davis (1999), Post (2000), and Sussman (2005), were explained with the aim of teaching students how to compose for a motion picture. Issues concerning composing for the media were addressed using Zager (2003) as a basis for learning about writing music for TV commercials, radios, and computer animations.

In the second section, creativity, defined by Sternberg (1988) as the creative person, was examined, along with the creative process, as defined by Wallas (1926), Webster (2003), Hickey (2003), and Sloboda (1988), and the creative product, as described by Tardif and Sternberg (1988). In the present study, Amabile’s (1996) framework of creativity was adopted. Creativity in children and adults was studied based on the work of Gardner (1982).

In the third section, studies such as Sloboda (1985), Gardner (1983), and Webster (1988, 1990) were considered. In investigating composition, Davidson and Welsh (1988), Scripp, Meyard, and Davidson (1988), and Webster (1992), showed that the concepts of creativity and problem-solving were related in music composition, were drawn on. Composing strategies were studied using the research of Paynter (2000), Hogg (1993), and Burnard (1995), made proposals in the fields of teaching and learning composition in general. The differences between improvisation and composition were described, as defined and explained by Schon (1983), Bergman (1987), and Swanwick (1988). Olsson’s (1993) and Ruud’s (1992) work on style, genre, and musical languages were also outlined.

In the last section, research into composition, from that of children to that at the professional level, was reviewed by looking at Swanwick’s (1994) model, Kratus’s
(1985) model, and Bennett’s (1976) model from a developmental perspective. The trend of studying composition using computers revealed the significant changes from notation in music composition to studies in composing behaviour from the 1970s to the present.

To strengthen the rationale of the study, the concept of musicianship commonly known as basic musical concepts with a collection of knowledge in the training of musicians will be investigated in the creative process, especially in the MIDI file observation. In this research, a computer sequencing program is used to implement any of these skills. Rowe (2001) mentioned about the use of computer programs in musicianship as “to make sense of what is heard, perform music expressively, or compose convincing pieces” (p.1).

As a result of reviewing the literature, it was decided that music technology would be used. The sequencing software program Sonar 3 was chosen as it was accessible to the target population using PCs and allowed for interaction between the student and the composition in the computer laboratory and at home.
In studying how people create, the most natural way is to collect those writings where creative persons have tried to give an account of themselves. Then one can try to construct a theory to match what they report. (Perkins 1981, pp. 10-11)

The purpose of this chapter is to outline the research design, the research process, and the methodology adopted in the data collection and analysis. The chapter is divided into four sections. The first section contains the research design, program, research plan, and freedom of choosing time of composition, as well as the hardware and software used in the study. The second section consists of the procedure, stages, survey, subjects, tasks, instructions, and music concepts used during each session of the project. The third section provides a description of the methodology employed in data collection through semi-structured interviews, reflective journals, written reports, and MIDI file observation. The fourth section contains the procedures for the analysis of the data.

4.1 AIM AND RESEARCH QUESTIONS

The aim of the study was to observe, record, and analyze the enhancement of students’ musical creativity using music technology. The four research questions were:

1. How does music technology enhance the creative process of computer-assisted composition and multimedia composition in terms of the visual image and music?
2. How do the selected participants respond to computer-assisted composition?
3. How does the visual image interact with the musical elements in multimedia composition?
4. What developmental patterns emerge as a result of research questions 1, 2, and 3?

To answer the research questions, four sources of data were examined: (1) semi-structured interviews undertaken during the creative process, (2) reflective journals collected during the process, (3) written reports collected after the creative process, and (4) MIDI file observations undertaken after the process.

4.2 RESEARCH DESIGN

The first section of this chapter describes the overall plan, process, and product of the module Creative Multimedia Music Project, which was taught from September 2003 to June 2004 at the HKIEd. This section begins with a detailed description of the research design and data collection process. The study used information from the module as a major source of data. The module introduced students to composition using music technology and prepared them for composing using MIDI, arranging and scoring for pictures and images. It involved the teaching of two creative music tasks to the students. The first task was composing with MIDI and the second task was composing for computer animation. The tasks were followed by the design and presentation of the creative projects by the students, and the analysis of the MIDI files, self-reflective journals, and interviews of the participants by the researcher. The strengths of using methodological triangulation in qualitative methods is to use multiple methods in studying a single problem to specify minimum samples based on expected reasonable coverage of the phenomenon. The weakness is to avoid overgeneralization in the in-depth, purposeful sampling from the small sample size.
4.2.1 Program

The study was carried out within the Associate of Arts (Music) Degree program at the HKIEd. This is a 2-year program including about 90 students. The research was undertaken at the Taipo campus of the HKIEd. The program prepares the students to further their studies to Year 3 in other university degree programs. The details of the program outlined in chapter 2—Background. In this study, the samples are taken from the Associate of Arts (Music) Degree program at the sub-degree level instead of primary or secondary school level.

4.2.2 Research Plan

The research was conducted over the duration of a one-year project (2003-04). The project formed part of the professional studies of Year 2 students in the Associate of Arts Degree (Music) program. There were a total of 15 lectures in the module throughout the year. The class size was 20 to 25 students in two groups. Each three hour session comprised two hours of lectures and one hour of individual composing time, plus a tutorial. The students were able to compose in their spare time in the computer music laboratory of the Institute or at home.

4.2.3 Freedom to Choose Time of Composition

The purpose of creating an equipment set-up as similar as possible to the one in the student’s home, or at the computer music laboratory, was to create the freedom to choose the time of composition. The reason for using the PC as the main computer for composition of the task in the research project was that it was similar to the one that the participants usually used at home. The student could make use of their time freely, to compose wherever they wanted, either at home or in the computer music
laboratory.

4.2.4 Hardware

The hardware used in this research consisted of 22 workstations in the computer laboratory, each comprising a PC computer, a MIDI keyboard, a Roland Sound Canvas module, a sound card for digital audio, and a MIDI interface. The students were allowed to choose whether to use headphones or to listen through loudspeakers. All the changes, including the MIDI channel, sounds on the module, and the volume of each track, were made through the computer. The equipment was checked before every lecture. This set-up and arrangement allowed any changes to the program, MIDI channels, patches, and controller data to be saved on the MIDI files for future analysis.

4.2.5 Software

The development of computer music software has undergone rapid development during the last decade. The musical applications for computers can basically be divided into three groups of software: sequencing software, notation software, and digital audio editing software. In the present study, the sequencing software Sonar 3 was used to run with the notation and mixing console, digital audio editing, and samples. The sequencing software placed a strong emphasis on the recording of tracks rather than music notation. The main reason for using the sequencer program was that it does not have a strong link to the traditional ways of creating music. The notational software Finale is also provided to assist students who are non-keyboard major in order to minimize the keyboard proficiency issue in this research. The use of sequencing and notational software are both provided in the lab for the students to choose during the creative process in task one and task two.
4.3 RESEARCH PROCESS

4.3.1 Stages

The overall design of the study involved the following stages:

**Stage I**

The first phase was the research plan, the research design of the study, and the seeking of approval from the Head of the Division of HKIEd. The next step was to get approval from the RMIT University Ethics Committee. A consent form was signed by the students and collected from them (see Appendix II).

**Stage II**

A survey was conducted. After the data had been collected, a preliminary analysis was undertaken. From this, 10 participants were selected and their profiles collected.

**Stage III**

The first part of the data collection was conducted. Bi-weekly journals were provided for the participants to record their thoughts and ideas. Floppy disks were provided for the participants to save their MIDI files. Individual interviews were conducted and videotaped during the composing process. Finally, Task One was finished during the first semester and students’ written reports were submitted with their computer-assisted compositions.

**Stage IV**

The same sets of data sources were collected. Bi-weekly journals, floppy disks, and individual interview scripts were collected during the second stage of the data collection. Finally, Task Two was finished during the second semester and students’
written reports were submitted with their multimedia compositions.

**Stage V**

All four data sources of information from Task One and Task Two were retrieved. The findings of Task One and Task Two were presented. The relationships between the four data sources in Task One and Task One were discussed. A triangulation of the four data sources was undertaken through data analysis. Finally, similarities and differences in the two different types of compositional practice were discussed and suggested frameworks or model devices in the creative process of computer-assisted and multimedia composition were provided to assist in the resolution of research questions 1, 2, 3, and 4. The implications for current research in music technology and music education were outlined. From these suggestions, the application of music technology in the new music curriculum is recommended.

**4.3.2 Ethics Procedures**

The first step was to seek approval from the Head of the Division of HKIED (see Appendix III). The next step was to get approval from the Ethics Committee from RMIT University. After the preliminary survey, ten participants were selected from the 45 students for in-depth interviews and analyses of their compositional process. The participants were required to sign the plain language statement as an indication of agreement to participate in this research (Appendix I) incorporating the consent form (Appendix II).
4.3.3 Sample Selection

The sample selection reported on a preliminary survey that was conducted with the Associate of Arts Degree (Music) students in 2003 in order to investigate the students’ experience and background in composition using music technology. An important component of the study was to survey the students’ previous education and experience in music technology in secondary school.

4.3.4 Subjects

Forty-five students in the Creative Multimedia Music Project in the Associate of Arts (Music) Degree program were invited to participate by completing a survey. Using the completed survey, 10 participants were selected from 45 students according to three criteria. Due to the large class size, 45 students are divided into two groups and 5 participants are selected from each group to minimize the sampling bias effect. The first one is the student’s experience and background in music software and hardware. The second one is the level of keyboard skills. The third one is the age, sex and student’s experience in composition. The collected data from the survey is shown in chapter 5 data presentation. In-depth interviews and analyses of the compositional processes of the 10 were eventually undertaken in the main study. The researcher gave a copy of the preliminary survey form in English (see Appendices IV) to the 45 students.

4.3.5 Purpose of the Survey

The purpose of the survey was to:

1. investigate the students’ experience and background in composing with MIDI in Hong Kong secondary schools and the kind of software or hardware they used in
their schools;
2. survey the distribution of different levels of keyboard skills (the level of keyboard skills is typically perceived by teachers and students to affect the quality of composition in computer-assisted composition); and
3. survey the students’ experience in studying composition and their background knowledge of music technology.

From this survey, the students’ experience and background in composition were illustrated. Both the MIDI keyboard and notational software were available in this research to eliminate the differences between keyboard and non-keyboard players.

4.3.6 Design of the Survey

The information in the survey was categorized into four parts. The following section describes the content of each part of the questionnaire.

Part I contains three questions to obtain personal information, specifically the name, sex, and age of the student.

Part II seeks information on the distribution of keyboard skill levels. The information includes the grade or level the students have achieved.

Part III surveys the students’ experience in sequencing software and hardware.

Part IV surveys the students’ experience in composition with a private tutor and the duration of their study of composition.

All these data were determining factors in selecting particular students as subjects in the creative process.
4.3.7 Administration and Collection of Data

After the process and functions of the survey had been explained, the survey was conducted in the first lecture of the Creative Multimedia Music Project. All 45 questionnaires were collected. After the completed questionnaires had been collected, a research assistant inputted the data using Microsoft Excel and the researcher verified that all information was correctly coded.

4.4 THE TASK

The way the task was presented was important due to the demands and expectations of both the researcher and the participants. There is, for example, a big difference between the instruction “do whatever you want,” and “you are meant to compose for six weeks and there will be a presentation at the end of the project.”

A preliminary test was given to the participants in the laboratory so that they could familiarize themselves with both the software and the hardware. The assignment was a piece of music of about one to two minutes in duration, and takes at least four recording tracks on the software.

4.4.1 Scheme of Work

In Table 4.1, the scheme of work distributed to students in the first lecture of the module is shown. The participants were informed of the topic, teaching content, assessments, and the task given after each topic.
Table 4.1

*Scheme of Work*

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic/Content</th>
<th>Main Teaching points</th>
<th>Activities/ Score</th>
<th>Assignment/ Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sequencing (I)</td>
<td>Tracking, real-time recording, simple editing,</td>
<td></td>
<td>1-2 tracks (1 min)</td>
</tr>
<tr>
<td>2</td>
<td>Sequencing (II)</td>
<td>Quantizing, split drum tracks, panning, mixing and effects</td>
<td></td>
<td>3 tracks (1.5 mins)</td>
</tr>
<tr>
<td>3</td>
<td>Composing with MIDI (I)</td>
<td>Horizontal and vertical writing</td>
<td>Homophonic and polyphonic</td>
<td>Write a short piece of music with at least 4 tracks (1-2 mins)</td>
</tr>
<tr>
<td>4</td>
<td>Composing with MIDI (II)</td>
<td>Arranging for band</td>
<td>Combo section</td>
<td>Arrangement for band</td>
</tr>
<tr>
<td>5</td>
<td>Composing with MIDI (III)</td>
<td>Arranging for orchestra</td>
<td>Strings doubling, the use of woodwind, brass and percussions</td>
<td>Arrangement for one section</td>
</tr>
<tr>
<td>6</td>
<td>Composing with MIDI (IV)</td>
<td>Arranging for band and orchestra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Visual image and music (I)</td>
<td>Video processing</td>
<td></td>
<td>Task I compose and arrange a piece of music (3-4 mins) for band or orchestra</td>
</tr>
<tr>
<td>8</td>
<td>Visual image and music (II)</td>
<td>Time frame and synchronizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Visual image and music (III)</td>
<td>Motion picture and music</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Visual image and</td>
<td>Tutorial:</td>
<td></td>
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<tr>
<td>11</td>
<td>Visual image and music (V)</td>
<td>Tutorial: Composing for the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Visual image and music (VI)</td>
<td>Tutorial: Composing for the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Individual Presentation (I)</td>
<td>Work design, processes, product, and analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Individual Presentation (II)</td>
<td>Work design, processes, product, and analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Sharing Session</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4.4.2 Task One

The first task was to either extend the preliminary test or recompose a longer piece of music in three to four minutes by using at least eight recording tracks on the software. The findings of Task One were closely related to research questions 1 and 2:

1. How does music technology enhance the creative process of multimedia composition in terms of visual image and music?

2. How do the selected participants respond to the computer-assisted composition?

### 4.4.3 Task Two

The second task was to compose a soundtrack for a selected video clip. The video clip is a one-minute computer animation produced with Flash software as a stimulus for the participants to integrate both audio and video components. At the end of the semester, the participants were asked to do a presentation on their own work, the.
process, and the analysis.

4.4.4 Instructions

All instructions regarding the options in the use of the sequencing software were explained during the tutorial sessions, which lasted one-and-a-half hour, and later upon request. Detailed explanatory notes and instructions were given during the lectures.

The profile of the instructor is provided because it may become a factor as the part of the delimitations in this study. The instructor graduated from the University of Missouri-Kansas City Conservatory of Music in 1995 with a Bachelor of Music Degree, majoring in composition and piano. He later furthered his musical studies at the Hong Kong Baptist University, receiving the Master of Arts (majoring in composition and electro-acoustic music) and Diploma of Education (majoring in Music) respectively in 2000 and 2002. A composer, pianist and researcher, he studied jazz piano and arranging with Prof. Kim Park, and composition under the tutorship of Prof. James Mobberley and Prof. John Chen, and has written over 40 compositions including works for orchestra, chamber ensemble, electro-acoustic music and writing music for TV commercials, movie soundtrack.

The aim of giving instructions was to convey sufficient information to make it possible for the students to start working on their own. Had general information been given together with the instructions, the brief would have become too detailed and therefore too prescriptive; this might have restricted both the creativity and imaginative potential of the student. Another reason for not giving too detailed a demonstration of all the options of the software was to see when and why the
participants would ask about the different possibilities offered by the software. The suitability of this approach was confirmed when some of the participants asked for assistance because they obviously felt the need for help with the sequencing software in their composition.

The questions that spontaneously arose from the students during the process were sometimes asked explicitly about a specific option, but more often, the requested option was expressed implicitly in their question. For example, one problem was formulated as follows: “Well, I want the part to be played with crescendo, but I can’t play it on the keyboard. Could I be helped in some way?” and the function of changing the volume was demonstrated.

In order to acquire optimal control of the instructions, information, comments, and answers given to the participants during composition, no other person but the researcher was available for giving instruction during the lectures. Consequently, because the aim was to let the participants make their decisions based on their own experience and values, they were never told what they should compose or in which style. When an opinion on the musical quality of a composition was solicited, the researcher always gave a few suggestions to the participants to guide them through the thinking process and never tried to influence them to compose in a certain way.

### 4.4.5 Concepts During Each Session

The purpose of teaching concepts during each session in the research process of the multimedia composition was to emphasize the use of technological tools to integrate the visual skills with musical skills. The project provided a demonstration that associated the visual image with a storyboard as a stimulus to the student’s
compositional skills. The concepts of visual stimulus and musical accent during each session are explained in the following section.

4.5 INSTRUCTIONS ABOUT MULTIMEDIA

The software Sonar 3 can integrate a movie (quick time or AVI format) or a sequence with digital audio. The Creative Multimedia Music Project collaborated with the Associate of Arts (Art and Design) program. The art and design students learnt computer animation in the Multimedia Art module and developed a 1-minute movie as their final assignment. The music students were required to compose a 1-minute soundtrack for the movie with the synchronization in video timecode.

4.5.1 Developing Visual Skills

Before the students started composing, the instructor asked them to watch the movie several times to gain an understanding of what it was about. The students watched the movie frame by frame in order to write down the sync points and accents in their journal. The judgment was solely determined by the individual students. The instructor did not give any opinions or comments at this stage.

4.5.2 Image-Associated Perception

The images activated the students’ abstract thinking and imagination in different ways. They were then asked to write down their perception of the images in their journal. Since the image is not stereotyped, each student could come up with different perceptions of the same images. This process provided the opportunity to train their divergent thinking skills.
4.5.3 Creating a Storyboard

After the students had written down the sync point with the particular images, they started to create their own story with the aid of computer animation. Because the images were only symbols and numbers, the students could hardly think of a storyboard without associating it with and imagining the visual images.

4.5.4 From Story to Markers

In this stage, the students were asked to verbally present and share their ideas in class with the other students. This presentation could enhance the thinking process involved in reorganizing the meanings of the images, working on the sync points, and making up their own story. The next stage was to put markers on the sequence that would be aligned using video timecode.

4.5.5 From Markers to Composing

After creating the markers, the students had to search for a tempo and build a tempo and meter map for the sequence. At this stage, the students would start to think about the pulse of the movie and music. During this process, we were able to see how the students developed their ideas, textures, and instrumentation at the starting point. Musical elements such as rhythm, pitch, and spatial design were taken into consideration as well.

4.5.6 Developing Musical Skills

At the composing stage, the students may have associated a particular style with a visual scene. Some of them may have had to conduct further research on a musical style that they had not encountered before. In this way, it was meaningful to see how
composers solved the problem using the stimulation of visual images. Some students might have started composing something in a style of which they had little previous experience.

4.5.7 Summary

From this research project, a conceptual flowchart was developed to examine the creative process of multimedia composition (Figure 4.1). This flowchart showed that the students started with a visual image and proceeded to acquire the necessary musical skills. The interchange between the visual and the musical led to further development.
Figure 4.1. The Conceptual Flowchart of Multimedia Composition (Chen, 2005, p. 58)
4.6 DATA COLLECTION

An outline of the method adopted for this research project follows. In this section, descriptions of the various components employed are given and the applicability of the components of the study is explained.

Because the focus of the study was an investigation of how students compose with technology, a descriptive mode was adopted. To describe the thoughts and strategies that occurred to students when they composed with technology, the following data-gathering techniques were used: semi-structured interviews, reflective journals, written reports, and MIDI file observation. Through reflective journals, students’ decision-making and problem-solving techniques were recorded. The semi-structured interviews provided information about the students’ composing process during and after this process. Students’ written reports provided information on how the musical element work in the composition was retrieved and affirmed the findings of the interviews and from the journals. Lastly, the MIDI file observation enhanced the data collected through the sequencing procedure.

The use of multiple data-gathering techniques allowed the researcher to check and recheck information gathered from each source. The following description of each technique indicates the data sources for the methodology employed.

4.6.1 Interviews

Gathering information from interviews can uncover thoughts that may not have been revealed through other methods of data collection. Maxwell (1996) supported the use of interviews because they are one avenue, among others, to gather “descriptions of actions and events” (p. 76). In an attempt to uncover what students think while
composing about their composing processes, and about composing with music technology in general, semi-structured interviews were employed and open-ended questions were used.

It was Maxwell (1996) who proposed the asking of open-ended questions. Open-ended questions allow us to see through the participants’ eyes and to capture their understanding or thoughts about what is occurring. Capturing as much data from the participants as possible lessens the chance of the researcher interpreting meaning, and heightens the chance of “understanding the perspective of the people studied and the meanings they attach to their words and actions” (Maxwell, 1996, pp. 89-90). To avoid developing our own interpretations of the meaning of others, Maxwell suggested, among other things, eliminating closed, leading, or short-answer questions, and incorporating open-ended questions that are followed by probes. This is important to the validity of the study. In the present study, questions such as, “Why are you changing the style?”, “What were you thinking about before you compose?”, and “What was the instrumentation you were searching for?” were all examples of open-ended questions.

Probes are used to elicit information beyond what is offered in response to the open-ended questions. Questions and statements such as, “What did you mean by…?”, “Tell me a bit more about that, please,” “Anything else?”, and “What else?” are examples of prompts that follow the students’ responses. They are used to uncover any information that might otherwise have gone unnoticed (Maxwell, 1996, pp. 89-90).

Semi-structured interviews are defined as those that include a set of structured
questions that are followed by open-ended questions (Borg & Gall, 1989). The questions are asked to uncover the students’ thoughts on their composing activities.

In this study, the purpose of the individual interview was to investigate how the creative activities were perceived by the participants. All interviews were videotaped and transcribed.

4.6.1.1 First Interview

A pre-test in the research project was given to see how well the students comprehended the technology and to let them familiarize themselves with the software and hardware for composing. The first interview was therefore conducted when the participants had finished Task One. The first interview questions are in Appendix VI.

After Task One was completed, interviews were carried out that were based on the students’ work. During the interview the participants described how they worked and what thoughts underpinned their actions. The basic focus of these interviews was consequently on the processes and the participants’ thoughts about them. At the start of the interview, the researcher and the participants listened to the composition together, and the participants presented the earlier versions of the same composition for comments during the interview.

In preparation for the interviews, the MIDI files were studied by the researcher in order to obtain an idea of what the participants had done and what to focus on in the interview. The interviews often turned out to be more like conservations, with the composition as a “mutual subject” (Bengtsson, 1993, p. 209). It was important that
even if an interview had a loose structure and was perceived by the interviewee as a casual conversation, the purpose of it from the perspective of the interviewer still remained to learn as much information as possible about the items discussed. This was described by Bengtsson (1993) as follows:

Even if some methods in the social sciences have some traits in common with dialogue, e.g. in-depth interviews, we should not be deluded by the similarity. The social scientist always does his research as a stranger, as an observer. An interview is never a dialogue. The scientist is only interested in getting as much information as possible from the interviewee. He or she does not say anything about his or her own personal experiences, and he or she does not comment on the reports of the interviewee, except for getting more and precise information. The relation is one-sided. (p. 209)

Bengtsson (1993) mentions above that the data collected from an in-depth interview between the researcher and participant must be two-sided, but not one-sided. The composition becomes a mutual subject in the discussion in the interview.

The interview questions were divided into three categories. The first category concerned the preliminary thinking process, the second concerned music technology as the means, and the third concerned the musical thinking process. The interview questions are listed along with the related research questions in Table 4.2.
Table 4.2

*The Relationships between the Interview Questions and Research Questions in Task One*

<table>
<thead>
<tr>
<th>Interview Questions</th>
<th>Related Research Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first part of the interviews concerned the preliminary thinking process:</td>
<td></td>
</tr>
<tr>
<td>1. Did you start the composition with writing the actual notes on paper or recording the notes on the keyboard onto the computer?</td>
<td>1</td>
</tr>
<tr>
<td>2. Which way is easier for you?</td>
<td>1</td>
</tr>
<tr>
<td>3. What musical elements did you consider the most important before you started to compose? e.g. texture, melody, rhythm, form, harmony, instrumentation, etc.</td>
<td>2</td>
</tr>
<tr>
<td>4. Did you choose the instruments from the sound module or choose it aurally in your head as the first step?</td>
<td>1 &amp; 2</td>
</tr>
<tr>
<td>5. What was the inspiration for your piece?</td>
<td>2</td>
</tr>
<tr>
<td>6. Did you compose your piece with an intention or no intention?</td>
<td>2</td>
</tr>
<tr>
<td>The questions in the second part of the interviews were concerned with music technology as the means:</td>
<td></td>
</tr>
<tr>
<td>7. What do you think of the “quantization function”?</td>
<td>1</td>
</tr>
<tr>
<td>8. Is the “quantization function” useful in the making of your own music and how can it enhance your work process?</td>
<td>1</td>
</tr>
<tr>
<td>9. What do you think of the “mixing and panning function”? Did you find it useful to mix parts together?</td>
<td>1</td>
</tr>
<tr>
<td>The questions in the third part of the interviews were concerned with the musical thinking process</td>
<td></td>
</tr>
<tr>
<td>10. Did you find a particular style that you wanted to experiment with in your piece before you composed?</td>
<td>2</td>
</tr>
<tr>
<td>11. What do you think about the notion that the music technology can help transform the preliminary ideas into actual sound?</td>
<td>2</td>
</tr>
<tr>
<td>12. Did you start the piece with melody and accompaniment in</td>
<td>2</td>
</tr>
</tbody>
</table>
the homophonic texture, or in a polyphonic texture or both?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13. What do you consider is the best way to compose with music technology?</td>
<td>1</td>
</tr>
<tr>
<td>14. When would you regard the piece of music as complete?</td>
<td>2</td>
</tr>
<tr>
<td>15. Did you have a particular visual image in mind while you were composing?</td>
<td>3</td>
</tr>
</tbody>
</table>

The time factor turned out to be an important consideration in determining the results of the interviews with regard to the compositions. When the interviews were held close to the time of composing, the participants were mostly able to describe what they did and what they thought. It became clear, though, that those accomplishments were soon forgotten, and in some cases, the participants did not even recognize their own compositions when listening to them a month later, even with compositions about which they had provided a lot of information in an interview just a few weeks earlier.

4.6.1.2 Second Interview

After finishing Task Two, interviews were carried out based on the students’ work and the participants described how they worked and what thoughts underpinned their actions. The basic focus of these interviews was consequently on their activities and their thoughts about their work. The questions for the second interview are attached as Appendix VII.

The questions in the interviews were divided into three categories. The first category concerned the visual thinking process, the second concerned music technology as the means, and the third concerned the musical thinking process. The interview questions
are provided along with the related research questions in Table 4.3.
Table 4.3

The Relationships between the Interview Questions and Research Questions in Task Two

<table>
<thead>
<tr>
<th>Interview Questions</th>
<th>Related Research Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first part of the interviews concerned with the visual thinking process:</td>
<td></td>
</tr>
<tr>
<td>1. How do you think visual ideas can stimulate your composition?</td>
<td>3</td>
</tr>
<tr>
<td>2. What is the relationship between visual images and musical ideas?</td>
<td>3</td>
</tr>
<tr>
<td>3. How did you identify the “associated objects” of the visual images?</td>
<td>3</td>
</tr>
<tr>
<td>4. How did the storyboard assist your composition?</td>
<td>3</td>
</tr>
<tr>
<td>5. What kind of mood did you associate with the visual images?</td>
<td>3</td>
</tr>
<tr>
<td>The questions in the second part of the interviews are concerned with music technology as the means:</td>
<td></td>
</tr>
<tr>
<td>6. How did you use the software markers in composing during the creative process?</td>
<td>1</td>
</tr>
<tr>
<td>7. How did you determine the appropriate tempo in the sequence?</td>
<td>1</td>
</tr>
<tr>
<td>8. How did the software integrate the motion picture and the music at the same time?</td>
<td>1</td>
</tr>
<tr>
<td>9. What musical elements did you associate with the visual images before you started to compose in this multimedia project?</td>
<td>3</td>
</tr>
<tr>
<td>10. Did you have a particular musical style emerging from the storyboard?</td>
<td>3</td>
</tr>
<tr>
<td>The questions in the third part of the interviews covered the musical thinking process:</td>
<td></td>
</tr>
<tr>
<td>11. How did you solve the problem when the music is not in sync with the visual images?</td>
<td>3</td>
</tr>
<tr>
<td>12. How did you treat the sync point musically?</td>
<td>3</td>
</tr>
<tr>
<td>13. How did the musical accent emphasize the sync point in the motion picture?</td>
<td>3</td>
</tr>
<tr>
<td>14. What are the limitations in music technology in this multimedia project?</td>
<td>1</td>
</tr>
<tr>
<td>15. Describe your experience of composing in this project. Will you compose with technology later after finishing this project?</td>
<td>1</td>
</tr>
</tbody>
</table>
4.6.2 Self-Reflective Journal

As Schon (1983) stated “We may reflect on action, thinking back on what we have done in order to discover how our knowing-in-action may have contributed to an unexpected outcome” (p. 26). This is called reflect on action. This kind of reflection has no direct connection to present action. Alternatively, we may reflect in the midst of action without interrupting it. We can still make a difference to the situation at hand. The thinking serves to reshape what we are doing while we are doing it. This is called reflect in action.

The participants were asked to write a self-reflective journal every two weeks. The journal was divided into two sections. The first section concerned how they used the musical elements during the creative process in tackling their tasks. The second section recorded how the participants reflected on their own piece of music. The participants could therefore express their own views about the development of their own piece and nurture self-awareness about their decision-making in composition. The participants were the first to encounter the problems, not the researcher. It was also a useful way for the researcher to investigate how students solved the problems when something happened in their composition because the piece of music may not reflect what they initially had in their musical brain.

The students were asked to consider different aspects of the creative process:

1. What was your inspiration for the piece?
2. What kind of problems did you encounter in the creative process? How did you solve them? (Refer to your reflective journal.)
3. What did you learn in the creative process through music technology?
The students were asked to write a summary of their self-reflective journal and comment on important learning experiences during the creative process. The questions and responses are presented in a table format followed by descriptive narratives of the responses. The journal reveals the students’ perceptions about the creative process of composing in relation to research questions 1 and 2 in Task One and research questions 1 and 3 in Task Two.

4.6.3 MIDI File Observation

The computer equipment, besides being a medium that facilitates composing, also offers new and fascinating possibilities for the study of the creative process in composition. Webster (1988) suggests that it “holds great promise for research” (p. 81). In the literature review, Sloboda’s (1988) four suggestions of possible methods of studying composition processes were presented, the third being the live observation of composers during a session of composition (p. 103).

Music technology is found to be helpful as a research tool in attempting to achieve the aims sketched out by Sloboda (1988), namely to gain access to “the notes written down, their sequence, and grouping in time” (p. 103). The option used was to continuously save the MIDI information as the creative process on the computer files, and thus to acquire the opportunity to follow, analyze, and compare the list of events afterward, from the initial idea through to the completed piece of music.

One important advantage of this method was that the participants could work individually, without having anyone watching them in close proximity. One general problem with observations and studies of the working process is, as mentioned before,
that the presence of the observer might disturb and influence the work itself, which may jeopardize its validity.

The method of saving all stages of the composition, from the start to the finish of the process, was to use the “save as” command, instead of the “save” command. In practice, this is done by changing the name of the document each time a new file is saved, and by changing the date following the name of the song. In this way, a number of documents and files that covered the creative process of the composition, and that were given different names arranged in chronological and numerical order, were saved. These files were used in the analysis and when preparing for the interviews.

Collecting and analyzing the various steps in the creative process is in fact a computerized realization of Sloboda’s (1988) suggested method of investigating composition by undertaking an examination of the history of a particular composition as displayed in the composer’s written manuscripts. Sketches and notebooks can show how a composition grows and changes over time in the composer’s mind.

The option used is to continuously save the MIDI information from the creating process in the computer files, and thus to compare the findings for Task One and Task Two in the experimental study. These documents will be used in the analysis chapter.

Trends are observed to response the research questions 1 and 2 in Task One and research questions 1 and 3 in Task Two. The MIDI file observations included (1) affirmation of the other data sources in the content of specific responses, (2) descriptions of how students enhance their composing activities through different
functions in using music technology, (3) the integration of improvising and composing through music technology, and (4) the alignment of visual stimulus and musical ideas in using music technology.

4.6.4 Written Report

The purpose of asking the students to submit their written report was to confirm the intention of their composition from other data sources such as MIDI file observation, interview scripts, and the self-reflective journal. From the participants’ perspective, they commented on and discussed their own musical works in both of the tasks to be collected with the MIDI file. The requested outline of the written report was given covering how they designed the piece using different musical elements, their stylistic analysis, and concluding with their reflections.

Design of the piece:

1. What was the main theme/motive in your piece?
2. How did you develop the theme? Please give specific examples and bar numbers.
3. Are there any harmonic progressions?
4. What was the instrumentation?
5. Write about the texture of your piece.
6. Discuss the form of the piece: for example, ABA, Rondo, theme, and variation.

The concluding remarks of the written reports contained descriptions of patterns that emerged from an analysis of the responses and a comparison of composing behaviours. Tables will be presented in chapters 5 and 6 to provide a snapshot of the
musical elements and show comparisons of the number of decisions in each element. These tables also showed how musical ideas are developed from the preliminary stage to the creative product. The responses from the participants’ written reports acted as supporting documents to research question 1.

4.7 DATA ANALYSIS PROCEDURES

This section outlines the procedures employed for data analysis. The data analysis will start with descriptions of how data were transcribed and will then provide an outline of the different steps used in the analysis. This is followed by a step-by-step description of the data analysis procedures, clarifying terms that emerged from the analysis and justifying steps taken during the analysis. In the data analysis procedures, Webster’s (2003) model is adopted as a reference point for the analysis. As a result of the analysis of answers to research question 1, commonalities within groups in terms of composing behaviours and interaction with the musical elements are discussed. As a result of the analyses of answers in research questions 2 and 3, commonalities within groups are discussed and discussions of developmental patterns within groups are included. Research question 4, which concerns patterns that emerged from the results of research questions 1, 2, and 3, is then discussed. This question is as follows:

4. What developmental patterns emerge as a result of research questions 1, 2, and 3?

4.7.1 Transcribing the Data

All the interviews were videotaped. Notes were taken during the interviews and entered into a Microsoft Word file. Any reflections that occurred while entering the field notes were added after the descriptions of the activities. Research assistants were used to transcribe the videotapes. One research assistant recorded the interviews with
a Sony Digital camera and oversaw the arrangement of the interviewees; the other research assistant listened to and watched the videotape and transcribed it using Microsoft Word.

The transcribed data for each session were collected while viewing the transcriptions, and videotaped. During the viewing, the content of the transcriptions from Chinese to English were verified by an external assessor (see Appendix V). Corrections were made if necessary; for example, the spelling of musical terms were amended and grammatical mistakes were ironed out.

4.7.2 Analyzing Interview Scripts and Profiles
When the transcriptions were completed, the students’ thoughts were reported and their actions described while they composed and participated in the semi-structured interviews. From the descriptions, patterns that emerged across the 10 selected participants were observed and discussed. Similarities and differences in the composing strategies and thinking processes across the samples were also discussed. Their profiles are presented in Chapter 7 and serve as a lens through which readers can view each student’s involvement as a composer. The decision to present profiles of each student is based on the belief that, as human beings, our experiences are unique and individual. Therefore, it is believed that each profile can provide rich information about the approach to music, about the thinking strategies that occurred while composing, and about specific thoughts concerning the nature of composing using music technology.

4.7.3 Analyzing Written Reports
The process of analysis involved repeated readings of the transcripts to verify and
determine categories. In defining categories, Miles and Huberman (1984) begin with an explanation of codes. They define a code as “an abbreviation or symbol applied to a segment of words most often a sentence or paragraphs of transcribed field notes in order to classify the words. Codes are categories” (p. 56). In the written report, the outline was given to the students before collection. Musical elements with which the students interacted included:

1. Theme (melody and rhythm),
2. Harmony,
3. Instrumentation,
4. Texture, and
5. Form.

When identifying the musical elements, concerns about each element were recognized and revealed through the written report. These concerns reflected decisions the students made on the treatment of the music material. The MIDI file observation of tracks in the sequence was related to the musical elements in the written report. Therefore, generalizations or patterns of composing behaviours would emerge in the data presentation and interpretation.

**4.7.4 Analyzing the Self-Reflective Journal**

The bi-weekly journal was collected and read by the researcher to identify the problem-solving techniques and decision-making processes during the creative stage. Since it is an individual composing behaviour, some of the students’ thoughts in the data presentation will be cited as evidence to affirm the response collected from the interview questions.
4.7.5 Analyzing the MIDI File through Observation

The main aim of the study was to qualitatively describe the processes involved in computer-based composition. This is also a basic prerequisite for the design of the study. In Task One, different ways of working were presented and their composition strategies were observed through the MIDI file. Screens of the MIDI tracks were used to demonstrate the development of the students’ thinking process with respect to strategies and ways of thinking, how exactly the technology was used, and how it affected the process.

In Task One, the MIDI tracks were observed, with particular reference to how technology affected the musical elements in the composition, such as texture, instrumentation, the development of the theme (melody and rhythm), harmony (progression), and form (the overall design of the piece). All these musical elements were presented in the students’ written reports. The MIDI file could be examined with special attention to the details and how the musical elements worked in the composition.

In Task Two, the MIDI file observation focused on how the technology integrates the process of visual images and music. A marker in the MIDI file is actually the sync point. The way the student treats the sync point musically was observed and discussed. There were different levels of awareness of the visual images among the participants. Finally, the composition strategies of Task One and Task Two were compared and are discussed in the data analysis chapter on the different composition strategies employed.
4.7.6 Triangulation

After the collected data had been sorted, the first analysis was carried out in order to establish the criteria for the final analysis. The interviews, journals, written reports, and MIDI file observation were read through and listened to several times. As a method of analyzing and describing the processes, triangulation between the different forms of data was carried out. This method of analysis was described by Hammersley and Atkinson (1983) as follows:

The term ‘Triangulation’ derives from a loose analogy with navigation and surveying. For someone wanting to locate their position on a map, a single landmark can only provide the information that they are situated somewhere along a line in a particular direction from the landmark. With two landmarks, however, their exact position can be pinpointed by taking bearings on both landmarks; they are at the point where the two lines cross. In social research, if one relies on a single piece of data there is the danger that undetected error in the data-production process may render the analysis incorrect. If, on the other hand, diverse data lead to the same conclusion, one can be a little more confident in that conclusion. This confidence is well founded to the degree that the different kinds of data have different types of error built into them. (p. 198)

Triangulation was therefore applied between the data from the computer MIDI files with the information about what had been done, what had been said in the interviews, and what had been observed in the journals and written reports. Out of this work, the criteria for analysis, and the grouping and presentation of the results finally emerged. A central point was the description of the composition process with respect to strategies and different ways of thinking, and how the computer software and
hardware were used to promote that work.

In the analysis, qualitatively different ways of composing music were identified. It is worth mentioning that the units of analysis were the 30 pieces of music, not the 10 participants. Consequently, the same participant may have used various strategies when composing music for different media, as a result of which his or her works ended up in different categories. At this point in the analysis, the connections between the individuals were temporarily dissolved (Marton, 1992, p. 9). The material for analysis was therefore constituted by the pieces of music, now with no connection to the individuals who made them. After grouping the composition processes with respect to the similarities among them, the focus was shifted in order to clarify the differences among these groups. The different categories of description were developed as a result. The logical relation between these categories was then described in a hierarchical system, which constitutes the framework of the research findings.

4.8 CONCLUSION

After reviewing the related methodology for this study, it was decided that utilizing multiple methods of data collection would be the most appropriate research methodology. Multiple methods of data collection provided useful ways to discern students’ thoughts and strategies. Many of the methods derived from the literature were adopted for the present study. The aim was to uncover the thought processes of students as they composed; to reveal students’ own perceptions of those processes; to discern whether there was any transfer between their composing practice and their thoughts on composing in general; and to see whether or not there were any patterns from a developmental perspective. Data were collected from multiple sources in an
attempt to provide as comprehensive a picture as possible of each student and each general trend.

With regard to the descriptions of the nature and quality of the collected data, and the criteria for the choice of methods, the investigation switched between the perspectives of the researcher and those of the participants. The description of the composition process was made from the perspective of the researcher. The different parts of the collected data that formed the basis for the analysis consisted of data seen from both perspectives. The interpretation of the computer files was made from the perspective of the researcher, whereas the interviews tried to capture the participants’ perceptions of the course of events. In the observations, both perspectives were utilized: the course of events as perceived by the student and the researcher, and the researcher’s descriptions of how the activity was perceived by the participant. In other parts of the results, in which the participants’ conceptions of composition are presented, and in the descriptions of what knowledge and skills the participants found were important or felt were missing from their work, the descriptions are made strictly from the perspective of the participants.

Consequently, the unit of analysis was a composition, thus leading to descriptions of qualitatively different ways of creating music. Furthermore, these categories were used to describe the participants’ ways of working and their development over time, and the principles that have guided their compositions, thus providing a thorough picture of the investigated practice.
CHAPTER 5
PRESENTATION OF THE DATA (TASK ONE)

This chapter reports on the findings of Task One in the Creative Multimedia Music Project and is closely related to research questions 1 and 2. To reiterate, the questions are:

1. How does music technology enhance the creative process of Multimedia composition – visual image and music?

2. How do the selected participants respond to computer-assisted composition?

The results of the analysis of the written reports, individual interviews, self-reflective journals, and MIDI file observation are presented in this chapter. From the results of the preliminary survey, 10 students were selected to participate in the study. Firstly, the profiles of the 10 participants will be introduced. Secondly, an analysis of the 10 written reports from the participants on their own composing practice is provided. Thirdly, the responses from the participants in the individual interview with regard to their attitudes to computer-assisted composition are examined. Fourthly, the participants’ reflective journals documenting the entire creative process involving problem-solving and decision-making are analyzed. Finally, the researcher’s observation of students’ compositional trends with substantial changes from the MIDI file throughout their use of technology are discussed.

5.1 RESULTS OF THE SURVEY

The purpose of the survey was to search the background in music technology of the 45 students enrolled in the Creative Multimedia Music Project of the Associate of Arts (Music) Degree program. All the students were invited to participate by completing a
questionnaire. The questionnaire of the preliminary survey is attached as Appendix IV. Ten participants were selected from the 45 students for in-depth interviews. Their compositional processes were examined in the main study.

The following tables illustrate the participants’ experience with keyboard instruments, computer music software, computer music hardware, and composition studies. This information provides a more in-depth understanding for the researcher when selecting the participants. According to the results of the survey, five of the participants were keyboard majors. The rationale was to test different approaches to the use of the MIDI keyboard and/or notational software in compositions. Furthermore, none of the 10 selected participants had previous experience of sequencing software and hardware before the commencement of the research. The aim was to avoid students with previous experience of computer music and compositions that would lead to preassumption in the findings and results of the study. Moreover, five male and five female students were selected to avoid gender discrimination.

According to Table 5.1, 40% of the students had achieved Grade 8 on the piano from the Associated Board of the Royal Schools of Music (ABRSM) and 60% of the students were below Grade 8. The purpose of the survey was to divide the keyboard and non-keyboard students into two groups and observe how they reacted to the MIDI keyboard and notation software during the creative process.
Table 5.1

*Experience in Playing Keyboard Instruments*

<table>
<thead>
<tr>
<th>Keyboard skills proficiency</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above ABRSM Grade.8</td>
<td>18</td>
<td>40%</td>
</tr>
<tr>
<td>Below ABRSM Grade 8</td>
<td>15</td>
<td>33.3%</td>
</tr>
<tr>
<td>Non-keyboard Major (more than 1 year of study)</td>
<td>5</td>
<td>11.1%</td>
</tr>
<tr>
<td>Non-keyboard Major (less than 1 year of study)</td>
<td>7</td>
<td>15.6%</td>
</tr>
</tbody>
</table>

According to Tables 5.2 and 5.3, 88.9% of the students had never used computer music sequencing software before and 95.6% of the students had never used computer hardware before. This served the purpose of the survey, which was to enhance the validity and reliability of the study as most of the students had no previous training in computer music software and hardware. Therefore, only students who had no previous training in computer music software and hardware were selected as participants in this research.

Table 5.2

*Experience of Computer Music Sequencing Software*

<table>
<thead>
<tr>
<th>Number of students using computer software</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who had used computer software before</td>
<td>5</td>
<td>11.1%</td>
</tr>
<tr>
<td>Students who had never used computer software</td>
<td>40</td>
<td>88.9%</td>
</tr>
</tbody>
</table>
Table 5.3

*Experience of Computer Music Sequencing Hardware*

<table>
<thead>
<tr>
<th>Number of students using computer hardware</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who had used computer hardware before</td>
<td>2</td>
<td>4.4%</td>
</tr>
<tr>
<td>Students who had never used computer hardware</td>
<td>43</td>
<td>95.6%</td>
</tr>
</tbody>
</table>

According to Table 5.4, 97.8% of the students did not have formal composition lessons with a private tutor. This figure shows that the levels of studying composition among this group of students were similar.

Table 5.4

*Experience of Studying Composition*

<table>
<thead>
<tr>
<th>Number of students who had studied composition with a private tutor</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who had studied composition with a private tutor</td>
<td>1</td>
<td>2.2%</td>
</tr>
<tr>
<td>Students who had never studied composition with a private tutor</td>
<td>44</td>
<td>97.8%</td>
</tr>
</tbody>
</table>

5.2 PROFILE OF PARTICIPANTS

The profile of the 10 participants was written by the students who were selected after the survey as supplementary information to enable their musical background to be better understood. Before the interview, all the participants were asked by the researcher to fill out a consent form as required by the ethics committees and they all agreed to have their identity disclosed.
Student A: W. K. Kom
Kom Wing Kei has been playing the piano for 16 years. She also learnt flute for about 2 years. She has reached Grade 8 in Piano and Theory, and Grade 5 in Flute, awarded by the ABRSM. She has participated in the annual Hong Kong Schools Music & Speech Festival in Vocal Solo and Piano Solo. In 2004, she graduated with an Associate of Arts (Music) Degree.

Student B: P. S. Lam
Priscilla Lam was a member of the school choir when she was in secondary school. In 2003, she passed Grade 8 Piano with merit. She then studied for the Associate of Arts (Music) Degree and furthered her studies in the Bachelor of Arts (Music Industry) course at the Royal Melbourne Institute of Technology (RMIT University) in 2005.

Student C: P. Y. Kam
Trista Kam started learning piano when she was about 6 years old. She took the Grade 6 piano examination of the ABRSM in 1997. She started to learn classical guitar in July 1998 and took the Grade 5 classical guitar examination of the ABRSM in 2000. In 2000 and 2001, she participated in the Annual Hong Kong Schools Music & Speech Festival. In 2000, she received a merit in the Junior Guitar Solo and the winning prize in Guitar Ensemble in 2001. She graduated with an Associate of Arts (Music) Degree in 2004.

Student D: S. N. So
Cindy So was a student in the Music Foundation Course at the Hong Kong Baptist University from 1999 to 2001. Between 2002 and 2004, she was a student on the
Associate of Arts (Music) Degree course. She studied piano from 6 years of age, and passed Grade 8 ABRSM in piano in 1996. She is interested in piano duets, and passed the ABRSM piano duet examination in 2001, receiving the Champion of the Hong Kong Schools Music Festival’s award in the piano duet section in 2000. In order to broaden her musical experience, she has participated in some competitions overseas, such as the Olympic Choir Olympic in Austria in 2000 and the Handbell Symposium in Korea in 2002. She furthered her studies in the Bachelor of Education (Primary) course at the HKIEd in 2004.

Student E: C. L. Choi
Nicole Choi was a student in the Music Foundation Course at the Hong Kong Baptist University. She obtained the Advanced Certificate in Piano Performance and Grade 5 in vocal performance from the ABRSM. She is interested in popular music, particularly in songwriting.

Student F: C. L. Yung
Eddy Yung was a viola trainee at the Music Office from 1989 to 2000. In this period, he joined many orchestras, such as the Hong Kong Youth Strings and the Hong Kong Youth Symphonic Orchestra. In 1998, he participated in a viola master class jointly presented by the Music Office and the Hong Kong Arts Festival Society, conducted by Professor Hong-Mei Xiao from the University of Michigan. He also performed in the joint concert of the Lincoln Youth Symphony Orchestra (USA) and the Hong Kong Youth Strings. In 2002, he studied for the Associate of Arts (Music) Degree and participated in the String Quartet at the HKIEd. From 2003, he joined the Millennium Youth Orchestra. He furthered his studies in the Bachelor of Music course at the University of Newcastle in 2005.
Student G: C. H. Tang
Tang Chung Ho passed Grade 5 in Double Bass and Grade 8 in Cello from the ABRSM in 1999 and 2002 respectively. He was the principal double bass in the Hong Kong Juvenile & Youth Chinese Classical Orchestra (HKJYCCO) and the Taipo District Chinese Orchestra. He also received a merit at the 52nd Hong Kong Schools Music Festival in Double Bass (Senior) and Bowed String Duet. He was invited to take part in performances with various orchestras; for example, the HKAPA Chinese Orchestra and the Millennium Youth Orchestra. He furthered his studies in the Bachelor of Music at the Hong Kong Academy of Performing Arts (HKAPA) in 2005.

Student H: K. L. Lai
Byron Lai, a guitarist, formed a rock band called Devilman in 2000 and joined the Hong Kong Guitar Orchestra in 2002 of which he remains a member. While studying music in the Associate of Arts Degree program in 2004, he learnt to play different styles of jazz and classical music. He achieved an ABRSM Grade 8 in classical guitar. He was a member of the AD (Music) Jazz Band.

Student I: M. F. Yeung
Calvin Yeung started playing electric bass guitar in 1996 and was involved in a band with schoolmates, playing mainly in pop and rock styles. The band has performed in the school’s annual Christmas concerts and participated in annual music contests in 1999. From 2002 to 2004, he played electric bass in the AD (Music) Jazz Band. In 2004, he graduated with the Associate of Arts (Music) Degree.
Student J: E. S. Huynh

Emery Huynh started learning piano at the age of four. In 1992, he participated in the Hong Kong Piano Competition and received the award for outstanding performance. In 1996, he obtained a Grade 8 in Piano from the ABRSM. In 2004, he passed the Trinity ATCL in Solo Piano with distinction.

In 2000, Huynh entered the Music Foundation Course at the Hong Kong Baptist University and became a member of the Hong Kong Baptist University Mixed Choir (BUC). In 2002, the BUC joined other university choirs and the Hong Kong Philharmonic Orchestra to perform in the Hong Kong Cultural Centre. He graduated from the Baptist University in 2002 and entered the Associate of Arts (Music) Degree program at the HKIEd from which he graduated in 2004. Huynh is also interested in composing. He wrote a Piano Quintet, *Tango*, which was performed by the AD (Music) String Quartet with piano. He furthered his studies in the Bachelor of Music course at the University of Newcastle in 2005.

5.3 RESULTS OF THE ANALYSIS FROM THE WRITTEN REPORTS IN TASK ONE

The participants were asked to write about the design of the piece after they had finished the composition. Each of them submitted a written report about how they responded to the musical elements as evidence of their musical development with reference to: 1. theme, 2. harmony, 3. instrumentation, 4. texture, and 5. form. The following data were derived from the report.
Table 5.5

1. Theme

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Measures 1-7, 4/4 time in G minor</td>
</tr>
<tr>
<td>B</td>
<td>Measures 9-25, 4/4 time in A minor</td>
</tr>
<tr>
<td>C</td>
<td>The motive was in D#, E, G. It could be found in measures 8, 10, and 12. The theme reappeared more than four times.</td>
</tr>
<tr>
<td>D</td>
<td>Initially, I started off my piece with a main theme in the classical style.</td>
</tr>
<tr>
<td>E</td>
<td>The main theme was the first phrase of the music. I developed the theme with some sequences and scalar patterns and encountered some imitations between two parts.</td>
</tr>
<tr>
<td>F</td>
<td>The piece was written in E minor for an orchestra. The main theme was a 16-measure phrase that started from measure 21 and was played by all strings tutti.</td>
</tr>
<tr>
<td>G</td>
<td>I tried to use G minor as the beginning key. Therefore, the main theme was in G minor with the note A♭.</td>
</tr>
<tr>
<td>H</td>
<td>It was mainly in F mixolydian. The main melody was played by trombone at measure 13, followed by the repetition of strings and trombone.</td>
</tr>
<tr>
<td>I</td>
<td>The motive applied in the piece is derived from an Arabic scale with the pitches C, D♭, E, F, G, A♭, B♭.</td>
</tr>
<tr>
<td>J</td>
<td>An introduction was used, and then the main theme appeared which was next to the introduction.</td>
</tr>
</tbody>
</table>

After observing the students’ written reports, it was noted that the first decision they made was whether to write a theme based on a scale, a specific motive, or selected pitches. Three of them considered a scale or mode as their first decision in writing the theme. Students G, H, and I decided to use a specific scale or mode; for example, Dorian mode, Mixolydian mode, and an Arabic scale. Seven of them considered the phrase, style, form, and pattern as their first decision in writing the theme. Students A, B, F, and G wrote the theme in a traditional minor scale. Student C started with pitches D#, E, and G. Student E used some scalar patterns and sequences to develop the theme. To summarize, the students tended to consider scales, modes, motives, or
selected pitches as their first decision in writing the theme.

Table 5.6

2. Harmony

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Gm → Cm → F → Bb → Gm → Cm7 → D</td>
</tr>
<tr>
<td>B</td>
<td>Am → Dm → E7 → Am</td>
</tr>
<tr>
<td>C</td>
<td>The progression is based on I → I7 → I → VII → I → VII → I → VII → I[6,4] → I</td>
</tr>
<tr>
<td>D</td>
<td>I decided to compose an isorhythmic piece.</td>
</tr>
<tr>
<td>E</td>
<td>The progression is based on I, ii, iii, and IV chords</td>
</tr>
<tr>
<td>F</td>
<td>Em → Cmaj7 → D7 → G → Am → D7 → G → Cmaj7/E → Cmaj7 → D7 → Cmaj7 → Em.</td>
</tr>
<tr>
<td>G</td>
<td>Since the piece was written in a polyphonic texture, no specific harmonic progression was designed in the process.</td>
</tr>
<tr>
<td>H</td>
<td>No response</td>
</tr>
<tr>
<td>I</td>
<td>C → Dm → C</td>
</tr>
<tr>
<td>J</td>
<td>No response</td>
</tr>
</tbody>
</table>

Following the writing of the theme, most of the students considered the harmonic progression in terms of harmony. Students A, B, C, E, F, and I developed their composition based on an harmonic progression. Six of them had planned a certain harmonic progression before they commenced. Student D decided to employ an isorhythmic technique in the task, so he did not use a particular harmonic progression. Student G planned to write the piece in a polyphonic texture, so no harmonic progression was initially designed in the process. Students H and J approached the task rhythmically without any harmonic progression in their pieces. Therefore, two of them did not mention any harmonic progression in the written report. Generally, the harmonic progression was therefore perceived to be crucial and practical to the students’ creative process.
Table 5.7

3. Instrumentation

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Strings, clarinet, horns, oboe</td>
</tr>
<tr>
<td>B</td>
<td>Voice, music box, piano, guitar, bass, harp, strings, vibraphone, French horn, flute, clarinet, percussion</td>
</tr>
<tr>
<td>C</td>
<td>Flute, oboe, clarinet, alto sax, tenor sax, bassoon, French horn, trumpet, trombone, tuba, bass and snare drum, marimba, acoustic piano, string ensemble, triangle, handy bells, dulcimer, vibraphone, tom-tom, hi-hat, cymbal</td>
</tr>
<tr>
<td>D</td>
<td>Celesta, tinkle bell, xylophone, shamisen, taiko drum 1, taiko drum 2, shaker, mute triangle, low bongo, low conga, low agogo, high wood block</td>
</tr>
<tr>
<td>E</td>
<td>Violin, viola, cello, trumpet, harp</td>
</tr>
<tr>
<td>F</td>
<td>Piccolo, flute, oboe, English horn, clarinet, bassoon, French horn, trumpet, trombone, tuba, glockenspiel, marimba, violins i &amp; ii, viola, cello, double bass, strings</td>
</tr>
<tr>
<td>G</td>
<td>FX5 (brightness), church organ, pad 4 (choir), pad 8 (sweep), FX 1 (rain), dulcimer, gunshot R</td>
</tr>
<tr>
<td>H</td>
<td>Acoustic bass, strings, trombone, bongo</td>
</tr>
<tr>
<td>I</td>
<td>Seashore, soundtrack (FX2), sitar, acoustic bass, electric bass (pick), electric bass (slap), keyboard, overdriven guitar, harp 1, harp 2, hi-hat, snare, bass drum, toms, cymbal, crash, ride, bongo, dj pad, whistle, lead, synth drum 1, synth drum 2, music box, gunshot, orchestral hit, synth bass</td>
</tr>
<tr>
<td>J</td>
<td>String ensembles I &amp; II, flute, oboe, horn, piano, vibraphone, bassoon, harp, tuba, trombone, cymbal, bell tree</td>
</tr>
</tbody>
</table>

The possibilities of choosing instruments on a General MIDI patch list or sound modules made the instrumentation more flexible. The wide range of instrumentation provides opportunities for the students to experience the mixture of traditional orchestral instruments and electronic sounds at the same time. The use of different instruments enhances the imagination and creativity of the students. Students D, H, and I have a unique and interesting combination of sounds in their instrumentation as a cross-cultural device. The boundaries in computer-assisted composition are
unlimited because students can always record an exotic instrument as an audio sample onto the computer and trigger it on the MIDI keyboard as an instrument. For example, Student D combined the Japanese taiko drum, shamisen—a three-string Chinese instrument, and Western percussion instruments such as the xylophone, celesta, conga, bongo, triangle, agogo, and woodblock as percussive sounds. Furthermore, students G and I used the electronic sound as recorded sound effects in the pieces such as seashore, soundtrack, FX rain, and gunshot to enhance their imagination.

Table 5.8

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1\textsuperscript{st} variation, 2\textsuperscript{nd} variation, 3\textsuperscript{rd} variation are in homophonic texture. 4\textsuperscript{th} variation is in a polyphonic texture.</td>
</tr>
<tr>
<td>B</td>
<td>The whole piece is written in a homophonic texture.</td>
</tr>
<tr>
<td>C</td>
<td>It is in a homophonic texture (melody and accompaniment). I used a lot of octave doubling to make it grander. I used some keyboard improvisation and broken chord as the accompaniment.</td>
</tr>
<tr>
<td>D</td>
<td>It is rhythmic, so it didn’t really have much melody and I would say it was polyphonic, which was having a rich texture of percussive instruments.</td>
</tr>
<tr>
<td>E</td>
<td>The texture is polyphonic in the piece.</td>
</tr>
<tr>
<td>F</td>
<td>The texture is contrapuntal.</td>
</tr>
<tr>
<td>G</td>
<td>The piece is written in a polyphonic texture.</td>
</tr>
<tr>
<td>H</td>
<td>The piece is written in a polyphonic texture.</td>
</tr>
<tr>
<td>I</td>
<td>The piece is written in a homophonic texture.</td>
</tr>
<tr>
<td>J</td>
<td>The piece starts in a homophonic texture, but ends in a polyphonic texture.</td>
</tr>
</tbody>
</table>

Five students (A, B, C, I, and J) used a homophonic texture and five students (D, E, F, G, and H) used a polyphonic texture in Task One. Homophonic and polyphonic textural writing had been taught by the instructor before writing the task. The significance of using different textures showed that the two-part or three-part writing
was essential in the track-layering process when they recorded their parts into the sequencing software. Therefore, the teaching of homophonic writing and contrapuntal writing had a strong impact on the relationship to the track-layering process in computer-assisted composition.

Table 5.9

5. Form

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Theme &amp; Variations</td>
</tr>
<tr>
<td>B</td>
<td>Theme &amp; Variations</td>
</tr>
<tr>
<td>C</td>
<td>A→B→A→C→D→A→B→A</td>
</tr>
<tr>
<td>D</td>
<td>Through-composed</td>
</tr>
<tr>
<td>E</td>
<td>A→B→A</td>
</tr>
<tr>
<td>F</td>
<td>A→B→C</td>
</tr>
<tr>
<td>G</td>
<td>Fast-slow-fast</td>
</tr>
<tr>
<td>H</td>
<td>Through-composed</td>
</tr>
<tr>
<td>I</td>
<td>AABA</td>
</tr>
<tr>
<td>J</td>
<td>Introduction→Main theme→Interlude→First Theme→Second Theme→Main Theme→Coda</td>
</tr>
</tbody>
</table>

The formal structures chosen for the compositions resulted in more variety than expected. In Task One, the form adopted tends to be more conventional except in the case of two of the compositions that are through-composed as in the work of students D and H. The conventional form had to do with the classical training of the music major students. Most of them chose the formal structure that they had performed or come across before. Table 5.9 shows the different ways the students resolved the structural aspects of composition. Students A and B used the theme and variation technique. Students C, E, F, and I used the traditional binary, ternary, or rondo form. Student J applied a standard formula of popular songs in his composition.
To summarize the findings from the brief written reports, it was observed that the students tended to write a theme based on a scale, specific motive, or selected pitches. The harmonic progression was crucial and practical during the students’ creative process. Furthermore, the possibilities of choosing instruments in a General MIDI patch list or sound modules made the creative process more flexible; cross-cultural instrumentation in particular emerged from using music technology to compose. Moreover, the teaching of homophonic and contrapuntal writing had a strong impact on the relationship with the track-layering process in computer-assisted composition. Finally, the formal structures chosen for the compositions resulted in more variety than expected.

5.4 RESULTS OF THE ANALYSIS FROM THE INDIVIDUAL INTERVIEW IN TASK ONE

After finishing Task One, individual interviews were carried out with the students while they were working on their composition. The interviews allowed the participants to describe how they had worked and what thoughts underpinned their actions. The focus of these interviews was on their activities and thoughts on the process.

The questions for the interviews were divided into three categories. The first category concerned the preliminary thinking process. This included a consideration of how the students responded to the MIDI keyboard and notational software, the priority of the musical elements, the choice of instruments, and their inspiration for the piece. The second category concerned music technology as the means. This included a consideration of how the students responded to the intention of the piece, the
functions of the sequencing software, and the musical styles. The third category concerned the musical thinking process. This included a consideration of how the students transformed preliminary ideas into physical sound, created texture, and composed with music technology.

In Table 5.10, the students’ responses to the MIDI keyboard and notational software are shown.

Table 5.10

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Composed with <em>Finale</em> software</td>
</tr>
<tr>
<td>B</td>
<td>Composed with MIDI keyboard</td>
</tr>
<tr>
<td>C</td>
<td>Using <em>Finale</em> music notation software</td>
</tr>
<tr>
<td>D</td>
<td>Composed with <em>Finale</em> music notation software</td>
</tr>
<tr>
<td>E</td>
<td>Composed with MIDI keyboard</td>
</tr>
<tr>
<td>F</td>
<td>Composed with <em>Finale</em> music notation software</td>
</tr>
<tr>
<td>G</td>
<td>Composed with MIDI keyboard</td>
</tr>
<tr>
<td>H</td>
<td>Composed with <em>Finale</em> music notation software</td>
</tr>
<tr>
<td>I</td>
<td>Using <em>Finale</em> music notation software</td>
</tr>
<tr>
<td>J</td>
<td>Composed with MIDI keyboard</td>
</tr>
</tbody>
</table>

The students had the options of choosing to compose either using music notation software or a MIDI keyboard. Six of them preferred using notation software and four preferred using the MIDI keyboard. Students A, C, D, F, H, and I composed with *Finale* music notation software. Students B, E, G, and J composed with a MIDI keyboard. The findings indicated that there was no relationship between piano majors who used a MIDI keyboard to compose and non-keyboard majors who used notation...
software. In Question 1, the data showed that Student G had not reached ABRSM Grade 8 on the piano. His first instrument was the cello, but he preferred using a MIDI keyboard to compose. Furthermore, both students A and D had achieved ABRSM Grade 8 on the piano, but they preferred to use notation software to compose.

In Table 5.11, the students’ responses to the use of notation and MIDI keyboard are shown.
Table 5.11

Question 2: Which way is easier for you?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Using <em>Finale</em> was easier, since I could hear the sound almost instantly, then I could think about the music (the composition) further, and make changes quickly.</td>
</tr>
<tr>
<td>B</td>
<td>Using the keyboard was easier, since I could make melodic improvisation from the harmonic progression instantly when I used the keyboard.</td>
</tr>
<tr>
<td>C</td>
<td>Using the computer was easier, because I could hear the actual sound.</td>
</tr>
<tr>
<td>D</td>
<td>I preferred composing with the acoustic piano since there were too many set-ups in the computer.</td>
</tr>
<tr>
<td>E</td>
<td>From keyboard onto computer was easier, since I could play all parts instantly, for example, strings instrument. Also, I could capture my emotion this way instantly.</td>
</tr>
<tr>
<td>F</td>
<td>Using <em>Finale</em> was easier, since I could hear the music as I chose to play back.</td>
</tr>
<tr>
<td>G</td>
<td>It depended on the textures of the music I wrote. It was easier to compose with staff paper when I composed the contrapuntal music, and recording onto the computer was suitable for the homophonic music.</td>
</tr>
<tr>
<td>H</td>
<td>Using the computer was easier, since I could record the music, and hear the sound instantly.</td>
</tr>
<tr>
<td>I</td>
<td>It depended on the situation. If the rhythm of the music was simple, I would use the MIDI keyboard; if the music was complicated, I would use the notation software.</td>
</tr>
<tr>
<td>J</td>
<td>I preferred using the keyboard to record onto the computer.</td>
</tr>
</tbody>
</table>

Students A, B, C, E, F, H, I, and J expressed their view that using music technology made it easier for them to compose. Student F claimed, “I could hear the music as I chose to play back.” Student E responded that “I could capture my emotions this way instantly.” There were eight students who used both notation software and MIDI keyboard to compose. Student D expressed her view that “there were too many set-ups on the computer” and Student G thought that “it depended on the texture of the music.”
In Table 5.12, the students’ responses to the priority of the musical elements are shown.

Table 5.12

Question 3: What musical elements did you consider the most important before you started to compose? For example, texture, melody, rhythm, form, harmony, instrumentation, etc.

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The most important was harmony. With the harmonic progression, I could develop the melody as a motive. Then I would be concerned about the texture, and instrumentation, etc.</td>
</tr>
<tr>
<td>B</td>
<td>The most important element of this piece in Task One was harmony. With the harmonic progression, I developed the melody and considered the instrumentation.</td>
</tr>
<tr>
<td>C</td>
<td>I considered harmony as the most important element of this piece, and then I considered the tempo and rhythm (I chose the heavily syncopated ragtime rhythm in this piece).</td>
</tr>
<tr>
<td>D</td>
<td>The most important element was harmony.</td>
</tr>
<tr>
<td>E</td>
<td>The most important element was the melody. After writing the melodies, I would choose the instruments. As different melodies overlapped, I would add the harmonic progression to fit them easily.</td>
</tr>
<tr>
<td>F</td>
<td>The most important was melody, then the harmony, and the last one was the instrumentation.</td>
</tr>
<tr>
<td>G</td>
<td>The most important element was the melody.</td>
</tr>
<tr>
<td>H</td>
<td>The most important element was rhythm in my piece. I’ve used the isorhythmic technique.</td>
</tr>
<tr>
<td>I</td>
<td>The most important was the style. Then I was concerned with the instrumentation and the harmonic progression.</td>
</tr>
<tr>
<td>J</td>
<td>The priority of importance was: melody, harmony, rhythmic pattern, tempo, instrumentation.</td>
</tr>
</tbody>
</table>

There were eight students, A, B, C, D, E, F, G, and J, who considered the musical
elements such as melody and harmony first. Students A, B, C, and D said that they considered the harmony first, while Students E, F, G, and J said that they considered the melody first. Student H considered the rhythm first and Student I considered the style first. This shows that the music students tended to think of melody and harmony as the first step when they composed with music technology.

In Table 5.13 students’ responses to the choice of instruments are shown.
Table 5.13

Question 4: Did you choose the instruments from the sound module or choose them aurally in your head as the first step?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I checked the sound to see if it was suitable. If not, I would change the instruments until the sound was satisfactory.</td>
</tr>
<tr>
<td>B</td>
<td>I imagined and listened to the tone colour of the instruments to see if they were suitable.</td>
</tr>
<tr>
<td>C</td>
<td>I tried it in the sound module. However, I would choose the percussion instruments (rhythm section) from the sound module, since I was not familiar with them.</td>
</tr>
<tr>
<td>D</td>
<td>I had the instrumentation in my mind, and then tried it in the sound module.</td>
</tr>
<tr>
<td>E</td>
<td>I chose some instruments aurally in my mind, and some instruments were my favourite instrument such as the harp.</td>
</tr>
<tr>
<td>F</td>
<td>I selected the instruments from the patch list from the sound module.</td>
</tr>
<tr>
<td>G</td>
<td>I chose it from the sound module, since the MIDI could not totally produce the sound in my mind.</td>
</tr>
<tr>
<td>H</td>
<td>I did it in both ways. For example, I chose the strings in my mind, and then I would choose the type of string instrument in the sound module, for example, the violin or viola.</td>
</tr>
<tr>
<td>I</td>
<td>I had decided the instrumentation before I composed a month ago.</td>
</tr>
<tr>
<td>J</td>
<td>I chose the instruments with the consideration of the register I needed foremost, and then tried them in the sound module.</td>
</tr>
</tbody>
</table>

Nine students, A, B, C, D, E, F, H, I, and J, agreed that they had their instrumentation in mind first and then select the instruments on the sound module. Only Student G chose the sound module first because the General MIDI could not help to produce the sound in his mind. This showed that most of the students had a very clear objective in combining and mixing different timbres or tone colours in advance. The findings proved that the hardware sound module was only a means to produce sounds in the
creative process of computer-assisted composition.

In Table 5.14, the considerations of how the students responded to their inspiration for the piece are shown.

Table 5.14

Question 5: What was the inspiration for your piece?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The inspiration was from a harmonic progression.</td>
</tr>
<tr>
<td>B</td>
<td>There were a few inspirations for my piece. Firstly the harmonic progression of the piece originated from a song’s progression; in the B section of my piece, the use of the mediant seventh chord as the borrowed chord, was inspired by the keyboard harmony textbook.</td>
</tr>
<tr>
<td>C</td>
<td>The inspiration was from the soundtrack of the film <em>Chicago</em>.</td>
</tr>
<tr>
<td>D</td>
<td>The inspiration was in a classical music style at the beginning of my composing. However, I changed the whole piece into a more rhythmic style, after I listened to the Gamelan music of Indonesia.</td>
</tr>
<tr>
<td>E</td>
<td>The inspiration was the free improvisation of the melodies.</td>
</tr>
<tr>
<td>F</td>
<td>The melody of the piece was derived from Shostakovitch’s music.</td>
</tr>
<tr>
<td>G</td>
<td>A TV game called <em>Evil City</em>, which was about the mysterious encounters of a wounded soldier in a castle.</td>
</tr>
<tr>
<td>H</td>
<td>I was inspired by a 20th century compositional technique called <em>the timeless effect</em>—everything goes wrong, and the instruments were played off beat.</td>
</tr>
<tr>
<td>I</td>
<td>After I heard Arabic music, the melody of the piece and scale were composed freely on the keyboard.</td>
</tr>
<tr>
<td>J</td>
<td>The progress from darkness to dawn.</td>
</tr>
</tbody>
</table>

Task One was an open-ended task in this research. According to the students’ responses, the inspiration for composing could be musical or extramusical. It was observed that Students A, B, E, and I started their initial ideas with musical elements, such as harmony and improvisation on the keyboard. Students C, D, F, G, H, and J
were inspired by extramusical elements, such as Broadway musicals, TV games, or scenery.

In Table 5.15, the students’ responses to the intention of the piece are shown.

Table 5.15

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No</td>
</tr>
<tr>
<td>B</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>Yes, my intention was the exploration of different rhythms.</td>
</tr>
<tr>
<td>E</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>Yes. I wanted to express the feeling of instability, loneliness, and sadness, but with some hope.</td>
</tr>
<tr>
<td>H</td>
<td>Yes. I composed this piece with an isorhythmic technique, which started in the wrong beat, but the rhythm ended together.</td>
</tr>
<tr>
<td>I</td>
<td>Yes</td>
</tr>
<tr>
<td>J</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Five students, A, B, C, E, and F, treated the composition primarily as a writing task without having any intention. Another five students, D, G, H, I, and J, would treat the composition as more than a task. Student G expressed feelings and Students D and H explored rhythmic techniques during the creative process.

In Table 5.16, the students’ responses to the transformation of sound are shown.
Table 5.16

Question 7: How did you turn your inner hearing into actual sound?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I inputed the music, little by little, in <em>Finale</em>, and listened to it to check if it was good or not.</td>
</tr>
<tr>
<td>B</td>
<td>I entered the music using the notation software and checked if it was good or not.</td>
</tr>
<tr>
<td>C</td>
<td>I recorded the music track by track (more familiar instrument first, i.e.: piano—accompaniment—wind section—brass section—percussion) to the computer and checked the sound to see if was acceptable or not.</td>
</tr>
<tr>
<td>D</td>
<td>I typed the music into the computer, and listened to it to check if it was good or not.</td>
</tr>
<tr>
<td>E</td>
<td>I could turn it into the actual sound through the piano, but I got higher accuracy when I played on the computer.</td>
</tr>
<tr>
<td>F</td>
<td>I would type the music in <em>Finale</em> and listen to the playback.</td>
</tr>
<tr>
<td>G</td>
<td>Firstly, the track of the keyboard showed the unstable feeling. In the middle section, the three-note figure similar to triplet appears. In the last section the music became more melodic.</td>
</tr>
<tr>
<td>H</td>
<td>I entered the music and listened to the playback.</td>
</tr>
<tr>
<td>I</td>
<td>For the more familiar instruments I didn’t need the assistance of the computer to know the effects or the sound of the music. For those less familiar ones, I would use the MIDI to listen to the sound.</td>
</tr>
<tr>
<td>J</td>
<td>I inputed the music into the computer, and listened to it. If it was not good enough, I would amend it.</td>
</tr>
</tbody>
</table>

All the students expressed the view that recording, listening, checking, and editing were the prominent issues during the creative process. They could benefit the most whenever they selected playback. Therefore, they could hear the music instantly when using the music technology to compose.

Layering was another issue that the participants stressed. It was fairly convenient for them to listen to the music track by track and section by section, and make changes whenever they needed using the software.
In Table 5.17, the students’ responses to the function of the sequencing software are shown.

Table 5.17
Question 8: What did you think of the quantization function? Was that useful in making your own music and how did it enhance your work process?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>It was useful when applied to the making of the rhythm section. However, I did not apply it in the making of the melodies, because it made the rhythm too accurate and not humanized.</td>
</tr>
<tr>
<td>B</td>
<td>I didn’t think it was helpful. It just made the music worse. I would see the staff view of the notation software and then I made the amendments to the rhythms.</td>
</tr>
<tr>
<td>C</td>
<td>I didn’t think it was useful. I would set a slower tempo to play the notes through the keyboard into the computer, especially when I was composing the rhythm section. If I typed the wrong note, I would delete it and type it again on the keyboard.</td>
</tr>
<tr>
<td>D</td>
<td>I did not use this function, because I typed the music onto the staff view when I dealt with the rhythmic section.</td>
</tr>
<tr>
<td>E</td>
<td>I did not apply it because it made the music both not emotional and not humanized.</td>
</tr>
<tr>
<td>F</td>
<td>Actually, I did not use that function since I typed the music using Finale.</td>
</tr>
<tr>
<td>G</td>
<td>It was excellent when it is applied to music, and gave a good accuracy to the melodic line.</td>
</tr>
<tr>
<td>H</td>
<td>It was a great function because it made the music more accurate.</td>
</tr>
<tr>
<td>I</td>
<td>It was very helpful especially when it was applied to the rhythm section. However, I thought the melody should not be quantized in too accurate a manner.</td>
</tr>
<tr>
<td>J</td>
<td>It was not very practical since the function was not humanized enough.</td>
</tr>
</tbody>
</table>

Four students, A, G, H, and I, thought that the quantization function was good when it was applied to the rhythm section. Another six students, B, C, D, E, F, and J, thought
that the function was too accurate and not humanized enough to express their work during the creative process. This implied that the function \textit{groove quantize} needed to be improved. The decision-making process would depend on the composer’s judgment about whether exact timing was necessary for the track or not.

In Table 5.18, the students’ responses to the function of the sequencing software are shown.

Table 5.18

Question 9: What did you think of the \textit{Mixing and Panning} function? Did you find it useful to mix parts together?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>It was practical since it helped me to make the real, spacious effects.</td>
</tr>
<tr>
<td>B</td>
<td>I used that function and found it quite powerful.</td>
</tr>
<tr>
<td>C</td>
<td>The solo, mute, and record functions on the main view were clear, especially when the sound became strange. The functions helped me edit some individual tracks.</td>
</tr>
<tr>
<td>D</td>
<td>It was valuable, especially when I mixed the different parts of the percussion instruments.</td>
</tr>
<tr>
<td>E</td>
<td>It was handy since it helped me to emphasize the dominating melody.</td>
</tr>
<tr>
<td>F</td>
<td>The mixing function was helpful and the panning function helped me balance the sound.</td>
</tr>
<tr>
<td>G</td>
<td>It was an imaginative function since it helped me make the music more surrounded with the left and right speakers in the later section of the music.</td>
</tr>
<tr>
<td>H</td>
<td>The panning function helped me make the music more surrounded with left and right speakers.</td>
</tr>
<tr>
<td>I</td>
<td>I thought it was not a complete work without mixing and panning.</td>
</tr>
<tr>
<td>J</td>
<td>Although I used it infrequently, it was quite useful. It was an editing function at a higher level, compared with the quantization function.</td>
</tr>
</tbody>
</table>
All 10 students agreed that the *Mixing and Panning* function was useful, especially for the balancing of sound and tracks. Students A and G mentioned that the spatial effect with panning functions was useful. The spatial effect could only be applied to the use of music technology and it could further be extended to creative ideas in using acoustic instruments. Student I even responded that “it was not a complete work without mixing and panning” because the final mix gave a good balance between different instruments.

In Table 5.19, the students’ responses to musical style are shown.

Table 5.19

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I composed this piece in the classical style, resembling the style of Beethoven.</td>
</tr>
<tr>
<td>B</td>
<td>I composed this piece that is similar to pop songs.</td>
</tr>
<tr>
<td>C</td>
<td>I wanted to compose a piece in pop and ragtime styles.</td>
</tr>
<tr>
<td>D</td>
<td>I intended to compose a piece in the Gamelan style, and I composed the rhythmic pattern similar to Gamelan music.</td>
</tr>
<tr>
<td>E</td>
<td>I composed this piece in the style of pop, but with a flavour of the romantic style.</td>
</tr>
<tr>
<td>F</td>
<td>I composed this piece in the pop style, played by the orchestra.</td>
</tr>
<tr>
<td>G</td>
<td>I planned to compose this piece in which the sound could produce a spatial effect.</td>
</tr>
<tr>
<td>H</td>
<td>I intended to imitate African drumming; the other aspects I mainly composed in more Western ways; for instance, I used Western instruments, and the Mixolydian mode.</td>
</tr>
<tr>
<td>I</td>
<td>I composed this piece in the rock style, which I was familiar with.</td>
</tr>
<tr>
<td>J</td>
<td>I started to compose this piece in the pop style which resembled to the music found in a motion picture soundtrack.</td>
</tr>
</tbody>
</table>
All the students agreed that they had a particular style in mind at the initial stage. In the task, the students were able to experiment with different musical styles in the creative process. The use of musical elements in a particular style could be an important factor in the decision-making process at the creative stage. Students A, D, G, and H, planned to compose the piece in a classical music, world music, and electronic music genres. Students B, C, E, F, I, and J planned to compose the piece in a pop, rock, and jazz style. The finding was that styles of music were quite diversified.

In Table 5.20, the students’ responses to the transformation of preliminary ideas into physical sound are shown.
Table 5.20

Question 11: What did you think about the notion that music technology can help transform preliminary ideas into actual sound?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes, I thought the music technology was transformative.</td>
</tr>
<tr>
<td>B</td>
<td>Yes, I thought my preliminary ideas were transformed into actual recording.</td>
</tr>
<tr>
<td>C</td>
<td>Yes, I thought the musical ideas are transformed into a real product through music technology.</td>
</tr>
<tr>
<td>D</td>
<td>Yes, but with some limitations, for example, the sound properties of the instruments were too perfect because the tone colours of the real instruments were a little bit “raw.”</td>
</tr>
<tr>
<td>E</td>
<td>Yes, I thought the music technology was transformative.</td>
</tr>
<tr>
<td>F</td>
<td>Yes, but with reservations. For example, the sound of a chord played by the MIDI seems to have less dissonance than the sound played by the real instruments.</td>
</tr>
<tr>
<td>G</td>
<td>Yes, in certain levels because the sound produced by MIDI was the electronic sound. It might not be the sound in my mind.</td>
</tr>
<tr>
<td>H</td>
<td>Yes, I thought the music technology was transformative.</td>
</tr>
<tr>
<td>I</td>
<td>Yes, I agreed. It was much better than thinking about the music in mind.</td>
</tr>
<tr>
<td>J</td>
<td>Yes, the actual sound could give me room to further refine my musical ideas.</td>
</tr>
</tbody>
</table>

The students thought that music technology could transform music in the mind into actual sound. However, Students D, F, and G expressed the view that the sound of MIDI instruments needed improvement to transform their musical ideas into creative products. The finding was that the organization of sound could activate the musical thinking of the students, particularly in teaching how to combine and integrate different musical elements for students of computer-assisted composition.

In Table 5.21, the students’ responses to texture are shown.
Table 5.21

Question 12: Did you start the piece with melody and accompaniment in a homophonic texture, contrapuntal passages in a polyphonic texture or both?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Generally, it was composed in a homophonic texture, with few contrapuntal passages.</td>
</tr>
<tr>
<td>B</td>
<td>I started the piece with a homophonic texture and in the middle section it became more contrapuntal.</td>
</tr>
<tr>
<td>C</td>
<td>Generally, the piece was composed in a homophonic texture.</td>
</tr>
<tr>
<td>D</td>
<td>Generally, my piece was composed in a contrapuntal texture because the music was composed in layers of percussion instruments.</td>
</tr>
<tr>
<td>E</td>
<td>The composition was in both textures: homophonic and polyphonic.</td>
</tr>
<tr>
<td>F</td>
<td>The first task was composed in a homophonic texture.</td>
</tr>
<tr>
<td>G</td>
<td>The piece was composed in a polyphonic texture because the tracks were layered, one by one, in the music.</td>
</tr>
<tr>
<td>H</td>
<td>It was composed mainly in a homophonic texture.</td>
</tr>
<tr>
<td>I</td>
<td>I started with the melody first and then the accompaniment in a homophonic texture.</td>
</tr>
<tr>
<td>J</td>
<td>I started with a homophonic texture, but ended in a polyphonic texture.</td>
</tr>
</tbody>
</table>

Students A, B, E, and J used both homophonic and polyphonic textures. Students C, F, H, and I used mainly homophonic texture, while two students, D and G, used mainly contrapuntal texture. The finding was that there was no difference in textural writing when composing with music technology.

In Table 5.22, the students’ responses to composing using technology are shown.
Table 5.22

Question 13: What did you consider the best way to compose with music technology?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The situation now was good enough for me to compose with music technology because I thought the computer workstation was convenient to use both at home and in the computer laboratory.</td>
</tr>
<tr>
<td>B</td>
<td>The best way was that a machine could sense my sleeping, or the colours and the pictures, and turn them into melodies.</td>
</tr>
<tr>
<td>C</td>
<td>The best way was some sequencing software containing the features of the notation software, such as <em>Finale</em>, which had a staff view, allowing composers to “copy and paste” and dividing the score into parts, etc.</td>
</tr>
<tr>
<td>D</td>
<td>The number of instruments in the sound module could be increased, and the reality of the sound could be improved. After those improvements, it could provide the best environment in which to compose music.</td>
</tr>
<tr>
<td>E</td>
<td>The best way was to compose without technical needs such as mixing, panning, quantization, etc.</td>
</tr>
<tr>
<td>F</td>
<td>The sound of the sound module could be more humanized, and the composing software should contain both sequencing and notation functions.</td>
</tr>
<tr>
<td>G</td>
<td>The situation should be changed because the number of channels was restricted to sixteen with one module, and the sound from the module was not good enough because the tone colour was too hard.</td>
</tr>
<tr>
<td>H</td>
<td>The best feature was that I was able to use the MIDI guitar controller. Also, I wish the computer could be set up with a sensor in the brain, so that I could compose music when I am thinking.</td>
</tr>
<tr>
<td>I</td>
<td>It would be better if the software could contain more sound effect devices.</td>
</tr>
<tr>
<td>J</td>
<td>The best way was to fully understand the music technology, such as the operation of the software, and the technical skills would become less important, compared with other composing methods.</td>
</tr>
</tbody>
</table>

The students gave lots of valuable comments on the design of the software and hardware developments. For example, Student C suggested that, “The best way was some sequencing software containing the features of the notation software, such as *Finale*, which had a staff view, allowing composers to ‘copy and paste’ and dividing
the score into parts, etc.” Student H stated, “The best feature was that I was able to use the MIDI guitar controller. Also, I wish the computer could be set up with a sensor in the brain, so that I could compose music when I am thinking.” Careful instruction had to be given in the use of the software functions, such as mixing, panning, and quantization, to let the student make the right choices. Furthermore, the basic set-up of the computer music workstation had to be explained clearly to overcome the technological issues that the student might face at home or in the laboratory.

In Table 5.23, the students’ responses to the completion of their piece are shown.
Table 5.23

Question 14: How did you know when the piece of music was completed?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I regarded the music as complete after the climax had been reached because the climax was important to me.</td>
</tr>
<tr>
<td>B</td>
<td>The music was completed when a few conditions were met: 1. when the form (structure) was complete; 2. when the instrumentation signaled the end of the music; 3. when I reached the perfect cadence.</td>
</tr>
<tr>
<td>C</td>
<td>The music was completed if the sound of the music was the same as the sound in my mind. Also, the music was completed after I found that the velocity, volume, instrumentation, and the tempo of the piece were acceptable.</td>
</tr>
<tr>
<td>D</td>
<td>It depended on the feeling and the flow of the music. In Task One, the music started from a slow tempo to a very fast one, and I would stop composing when the tempo could not be accelerated any more.</td>
</tr>
<tr>
<td>E</td>
<td>I regarded the music as complete when the piece was perfect, that was, there were no places in which it needed to be changed.</td>
</tr>
<tr>
<td>F</td>
<td>I regarded the music as complete after the changes of the tempo, keys, etc., and after the development section.</td>
</tr>
<tr>
<td>G</td>
<td>The music was completed after it had reached the climax.</td>
</tr>
<tr>
<td>H</td>
<td>The music was completed when I had presented all the musical ideas in the piece.</td>
</tr>
<tr>
<td>I</td>
<td>The music should be completed when it had reached the climax.</td>
</tr>
<tr>
<td>J</td>
<td>The music was completed when I had expressed my feeling sufficiently within the time limit.</td>
</tr>
</tbody>
</table>

The students pointed out that the completion of the piece could be associated with different factors: expression of feelings, forms, cadence, time restriction, tempo, and so on. Student J said that, “The music was completed when I had expressed my feeling sufficiently,” while Student D said that, “It depended on the feeling and the flow of the music.” Intuition and feelings became crucial points when the students regarded the piece as complete. However, for Students B, C, F, and H, the decision about when the music was complete depended on how the musical elements were
developed.

In Table 5.24, the students’ responses to the visual images are shown.

Table 5.24

Question 15: Did you have a particular visual image in mind while you were composing?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No, I just had the sound (of the music) in my mind.</td>
</tr>
<tr>
<td>B</td>
<td>No, I didn’t have any visual image in mind when I was composing.</td>
</tr>
<tr>
<td>C</td>
<td>Yes. I was watching a photo of a lady in an evening dress when I was composing.</td>
</tr>
<tr>
<td>D</td>
<td>Yes, while I was composing the beginning section I had the image of tribal dance.</td>
</tr>
<tr>
<td>E</td>
<td>No, I just composed with my emotion and my feeling at the time.</td>
</tr>
<tr>
<td>F</td>
<td>No, I didn’t have any visual image in mind when I was composing.</td>
</tr>
<tr>
<td>G</td>
<td>No, I didn’t have any visual image in mind.</td>
</tr>
<tr>
<td>H</td>
<td>Yes, I imagined a parade in the African grassland.</td>
</tr>
<tr>
<td>I</td>
<td>Yes, I imagined I was traveling in a time frame, from the ancient to the modern, when I composed the piece.</td>
</tr>
<tr>
<td>J</td>
<td>Yes, I had a picture of the dawn in my mind.</td>
</tr>
</tbody>
</table>

Five students, C, D, H, I, and J, had a particular image in mind while they were composing. This revealed that extramusical ideas could act as a stimulus to the students in the creative process, particularly in relation to the visual images in Task Two.
5.5 RESULTS OF THE ANALYSIS FROM THE SELF-REFLECTIVE JOURNAL IN TASK ONE

In this section, findings of the bi-weekly journal are presented to verify the problem-solving techniques and decision-making processes during the creative stage. The following tables illustrate the inspiration for the piece, issues and problems that were encountered, and the issues in using music technology to compose. The findings of the journal provided some of the thoughts and insights of the participants when they were using music technology to compose. This information provided another perspective to the composing strategies of the participants as reflective practitioners.

Since some of the collected data did not fit into the categories, some information was irrelevant in the journals. The irrelevant information was omitted because the rationale was that the researcher could not force the information into the matrix if it did not fit at all.

Table 5.25

*Inspiration from Musical Elements*

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Harmonic progression</td>
</tr>
<tr>
<td>B</td>
<td>Harmonic progression</td>
</tr>
<tr>
<td>E</td>
<td>Improvisation</td>
</tr>
</tbody>
</table>
Table 5.26

**Inspiration from a Musical Piece**

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Soundtrack (Pop Music)</td>
</tr>
<tr>
<td>D</td>
<td>Gamelan music (World Music)</td>
</tr>
<tr>
<td>F</td>
<td>Shostakovich piece (20th century music)</td>
</tr>
<tr>
<td>G</td>
<td>New Age piece (Pop music)</td>
</tr>
<tr>
<td>I</td>
<td>Sting piece (Pop music)</td>
</tr>
</tbody>
</table>

During the preliminary thinking stage, two types of inspiration found in the students’ journal findings. In Table 5.25, the inspiration was identified from musical elements. It was an improvisation of a harmonic progression. In Table 5.26, the inspiration was from a musical piece. The musical piece had a close relationship with the students’ listening preferences. It was considered as a model of composition for them to imitate or follow.

Table 5.27

**Issues / Problems Encountered**

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Linkage between variations</td>
</tr>
<tr>
<td>B</td>
<td>Linkage between sections</td>
</tr>
<tr>
<td>D</td>
<td>Imitating styles</td>
</tr>
<tr>
<td>F</td>
<td>Too many compositional ideas</td>
</tr>
<tr>
<td>I</td>
<td>Linkage between sections</td>
</tr>
</tbody>
</table>
In Table 5.27, students (A, B, D, F, I) faced the problem of organizing the musical elements in Task One. The linkage between sections seemed to be an important issue for the music major students in composing. Putting this linkage into the teaching content of the module could be a solution. To clarify this issue; the linkage between sections was a general problem of compositional technique rather than a technological issue. After all, it is up to the students to solve the issues by providing solutions. In this way, we can see that the technology is a tool and students can learn how to solve their own compositional problems during the creative process.

Table 5.28

Issues about Music Technology

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The software saves me lots of time in editing changes</td>
</tr>
<tr>
<td>B</td>
<td>Arranging rhythmic patterns for drum set</td>
</tr>
<tr>
<td></td>
<td>Panning position for a specific note</td>
</tr>
<tr>
<td></td>
<td>Choices of instrumentation can be expanded</td>
</tr>
<tr>
<td>C</td>
<td>Converting files from notational software to sequencing software</td>
</tr>
<tr>
<td></td>
<td>The sound quality of the instruments can be improved</td>
</tr>
<tr>
<td>D</td>
<td>The combination of world instruments is attractive</td>
</tr>
<tr>
<td>E</td>
<td>The editing in the quantization function is complicated</td>
</tr>
<tr>
<td></td>
<td>Ignore the real range of the instruments easily</td>
</tr>
<tr>
<td>F</td>
<td>The quality of the sample instruments can be improved</td>
</tr>
<tr>
<td>G</td>
<td>To pan the instrument as a surround sound is amazing</td>
</tr>
<tr>
<td>I</td>
<td>The conversion from MIDI to audio signals is convenient</td>
</tr>
<tr>
<td>J</td>
<td>The editing in the quantization function can be more user-friendly</td>
</tr>
<tr>
<td></td>
<td>Converting files from notational software to sequencing software</td>
</tr>
</tbody>
</table>

In Table 5.28, the issues about using music technology to compose can be placed in five categories:
1. Samples of the instruments

Students B, C, D, E, and F mentioned that the quality of the samples needed improvement. The suggestion corresponded with the findings from the semi-structured interview that the students would always assume the samples from the sound module had to be the same as those from real acoustic instruments because virtual orchestras had been widely used in music production. This was referred to in chapter 3 on digital film scoring. In fact, the synthesizer could extend the sample into a newly generated sound or newly designed instrument. At the university level, electro-acoustic music is usually only taught as part of a master degree. It would be too detailed to teach electro-acoustic music at undergraduate level. Therefore, most of the general public would think that music technology is only an imitation of acoustic instruments, but in fact it is not. It is the manipulation of sound and the design of a new instrument in the repertoire of electro-acoustic music.

2. Transferring files

Students C and J considered that transferring a file from the notation software to be sequencing software was an issue of computer-assisted composition. This confirmed the findings from the semi-structured interviews. Some of the non-keyboard players would have liked to have used notation software and transferred the file to the sequencer for further editing. In fact, transferring files was quite tedious and not user friendly because each piece of software was designed with a specific purpose. They were not compiled into a combined edition.

3. Spatial elements

Students B and G expressed the view that the mixing and panning function was an effective tool in music technology. Mixing and panning function could not apply to an
acoustic setting unless the instruments were recorded separately. This became a new musical element in composition.

4. Quantization function

Students E and J considered that the quantization function was not humanized enough to express their feelings. It was true that the issue of the function had been raised in the semi-structured interviews where it was felt that it was effective to apply it to the combo section and complicated rhythms.

5.6 RESULTS OF THE ANALYSIS FROM THE MIDI FILE OBSERVATION IN TASK ONE

In this section, the screens of MIDI tracks were used to demonstrate the development of the students’ thinking process. In Task One, the MIDI tracks were observed particularly to see how far the technology affected the musical elements in the composition, such as texture, instrumentation, the development of the theme, harmonic progression, and form. All of these elements were discussed in the written report. In the first view, it shows the initial stage of the composing behaviour of the participants. In the second view, it demonstrates the developmental stage of the composing behaviour of the participants. A certain type of composing strategy was described. The linkage between the two stages was observed and the connection with other data sources was discussed. The compositions of the 10 participants are attached in Appendix XIII CD-Rom One (Creative product of Task One—Computer-Assisted Composition).
Student A

Student A started the piece with a seven-measure harmonic progression which was based on the circle of fifths in Figure 5.1 as the student’s inspiration stated in the written report. She used the music notation software to input the score at the initial stage as mentioned in the interview. At a later stage, it was observed that the composing behaviour changed from a homophonic texture—melody and harmony—to a polyphonic texture with contrapuntal techniques in Figure 5.2.

*Figure 5.1* Student A—MIDI file tracks first view.

In the track view, it was observed that the composing behaviour changed in measure 37. The chasing of motivic material between the clarinet and bassoon was used as a
developmental composing strategy. It illustrated that the software could enhance the
textural thinking process into a musical experience more than a musical notation.

**Student B**

Student B started the piece with melody and harmony at the initial stage in Figure 5.3.
She mentioned that the piece is based on a homophonic texture in the interviews. She
further developed the piece by adding bass, drums, and guitar in Figure 5.4.

![Figure 5.3 Student B—MIDI file tracks first view.](image)

*Figure 5.3 Student B—MIDI file tracks first view.*
Figure 5.4 Student B—MIDI file tracks second view.

In Figure 5.4, in measure 16, the addition of rhythm sections with guitar, bass and drums developed the initial melody and harmony. The idea of dividing the piano part into right hand and left hand was observed since the software could record the parts individually into tracks. The software could let students concentrate on developing musical ideas with the imagination rather than having technical limitation on the piano part.
Student C

Figure 5.5 Student C—MIDI file tracks first view.

Student C started the piece in a Ragtime style as she mentioned in the interview and further developed the musical ideas with different instrumentation in Figure 5.6.

Figure 5.6 Student C—MIDI file tracks second view.
In Figure 5.6, it was observed that the instrumentation was expanded from a piano *ragtime* track into a *big band* version. The use of saxophone, brass, woodwind, and percussion sections showed that the software could further develop the musical thinking from a small piano piece into a larger orchestral form. The instrumental arrangement could let students explore the possibility of combining and removing instruments in the sequence and it could allow the student to hear the actual sound of the work.

**Student D**

![MIDI file tracks](image)

*Figure 5.7 Student D—MIDI file tracks first view.*

Student D started the piece with rhythmic ideas as mentioned in the interview and written report. The sequence consisted of pitched and non-pitched instruments. It was a through-composed piece with the intention of blending Japanese and Gamelan music. It was an obvious example to show the development of musical ideas with different regions’ instrumentation with computer-assisted composition in Figure 5.8.
Figure 5.8 Student D—MIDI file tracks second view.

Figure 5.8 illustrated that the software could develop the initial musical idea of combining East and South Asian musical styles in instrumentation. The development of spatial ideas was clearly shown in the track view with the Japanese Taiko drum being divided into left and right channels. The use of the mixing and panning function was to enhance the musical experience and extended the acoustic instrument into a virtual instrument.

Student E

Figure 5.9 Student E—MIDI file tracks first view.
Student E started the piece with an improvisational approach as mentioned in the written report. She used the MIDI keyboard as her primary instrument for improvisation. In Figure 5.9, she changed the patch list from keyboard to string sounds to explore a thinner texture and combined it with other orchestral instruments.

She mentioned in her interview that the Quantization function is not humanized enough to express her feelings. In Figure 5.10, it was clear that she did not quantize much in the sequence, especially in the string part. Although it sometimes made the song a little bit shaky in terms of rhythm and pulse to play back with other tracks of instruments, she proved that the linkage between composition and performance in this improvisational approach was essential. She recorded, listened, evaluated, and edited the parts until she was satisfied with the track. It revealed that the software was more than a tape recorder and it could build up the improvisational skills into a compositional approach in the creative process of computer-assisted composition.

*Figure 5.10 Student E—MIDI file tracks second view.*
In Figure 5.11, student F applied orchestration techniques to listen to the actual sound of the sequence. The harmonic progression was precomposed on the keyboard and he experimented with contrapuntal techniques layer by layer. He did the final editing, mixing, and panning with the sequencing software.

Figure 5.12 Student F—MIDI file tracks second view.
In Figure 5.12, student F shifted from the woodwind section to the brass section in measure 44 while the string pizzicato remained as an ostinato in the piece.

**Student G**

*Figure 5.13 Student G—MIDI file tracks first view.*

Student G started the piece with synthesized and computer generated sound as the sound source. In the interview he mentioned that the spatial element was an important issue in music technology. He divided the FX patches into three categories: left, middle and right in the tracks 9, 10 and 11 in Figure 5.13.

*Figure 5.14 Student G—MIDI file tracks second view.*
In Figure 5.14, in measure 47, the texture changed from a scattering introduction in Figure 5.13 to a more unison sound in the choir pad in Figure 5.14. It was used as a compositional device to use the instruments in pairs. It was clear that the software and hardware could act as catalysts for the imagination, especially by combining unusual settings to fit the music into context.

**Student H**

*Figure 5.15 Student H—MIDI file tracks first view.*

In Figure 5.15, student H started the piece with an isorhythmic technique as stated in the written report and interview. The instrumentation was basically a jazz set-up with congas. The hardware-sound module allowed him to experiment with jazz with the isorhythmic technique.

*Figure 5.16 Student H—MIDI file tracks second view.*
Figure 5.16 shows the sequencing software becoming a valuable tool in layering tracks. Student H started with a bass line in acoustic bass and rhythmic pattern in conga in Figure 5.15 and developed into an *isorhythmic* piece in Figure 5.16. From observing the draft of Student H it was possible to see that he had spent hours in writing the drafts by listening, and evaluating each part until the product satisfied him during the process of computer-assisted composition.

Student I

Student I divided the task into four sections with four different styles.

*Figure 5.17. Student I—MIDI file tracks first view.*

Figure 5.17 shows the soundtrack style. This section was based on major 7\textsuperscript{th} and 9\textsuperscript{th} chords.
Figure 5.18 Student I—MIDI file tracks second view.

In Figure 5.18, the sitar and acoustic bass merged into the next section in an Indian music style.

Figure 5.19 Student I—MIDI file tracks third view.
In Figure 5.19, student I used the mode to link the Indian style and hard rock style.

**Figure 5.20** Student I—MIDI file tracks fourth view.

In Figure 5.20, student I used the melodic motive from the hard rock style to the house style with two harps in the left and right speakers as the linkages.

In Figures 5.17, 5.18, 5.19, and 5.20, the transformations showed that music technology could motivate students to learn musical styles and apply them to music composition. It would be possible for the students to compose with technology in different styles in listening and evaluating the task. By using the motives, scales, modes, and harmony, student I tried different compositional approaches in linking different musical styles together in one piece. The words *bimusical* and *multimusical* were discussed in the literature review in chapter 3. This is an example of multimusicality to demonstrate how a student blends different musical styles in a composition.
Student J

Figure 5.21 Student J—MIDI file tracks first view.

Student J started the piece with an improvisational approach as mentioned in the written report. He used the MIDI keyboard for improvisation. In Figure 5.21, he changed the patch list from keyboard to string sounds to explore a thinner texture and combine them with other orchestral instruments.

Figure 5.22 Student J—MIDI file tracks second view.

He mentioned in the interview that the quantization function was not sufficiently
humanized for expressing feelings. In Figure 5.22, it was clear that he did not quantize much in the sequence, especially in the string part. Although it sometimes made the song a little bit shaky in terms of rhythm and pulse to play back with other tracks of instruments, he proved that the linkage between composition and performance in this improvisational approach is crucial.

5.7 SUMMARY OF FINDINGS FROM MIDI FILE OBSERVATION

Study of the MIDI file confirmed some of the findings from the written reports, journals, and interviews. Across the 10 participants, it was hard to generalize a particular composition strategy that would enable the formulation of a specific approach to Task One—Computer-Assisted Composition. As a matter of fact, each participant had their own composition strategy in using music technology to compose. Their problem-solving techniques showed their creativity in this open-ended task. This research project allowed each participant to use the same equipment, software, and hardware, but the products were three minutes of compositions which were totally unalike.

From the findings, two kinds of composing practice were observed across these 10 participants in using music technology to compose as follows:

- Listening ➔ Evaluating ➔ Recording ➔ Editing
- Playing ➔ Improvising ➔ Recording ➔ Editing

Figure 5.23 Two Kinds of Composing Practice in Computer-Assisted Composition.
This figure indicates that in the development of a composition, the composer continuously changes between two perspectives: playing-improvising and listening/evaluating. This method is based on the possibility of separating the procedures of recording, playing, listening, improvising, evaluating, and editing. In the first category, the music is often more formalized and precise. In the second category, the music is often more contextualized and humanized. In computer-assisted composition the composer continuously works out his/her creation by shifting these two categories around during the creative process.
CHAPTER 6
PRESENTATION OF THE DATA (TASK TWO)

This chapter reports on the findings resulting from Task Two in the Creative Multimedia Music Project. This is closely related to research questions 1 and 3. To reiterate, the questions are:

1. How does music technology enhance the creative process of multimedia composition—visual image and music?
2. How does the visual image interact with the musical elements in the multimedia composition?

The results of the analysis of the written reports, individual interviews, self-reflective journals, and MIDI file observation are presented in this chapter. Firstly, the analysis of the 10 written reports from the participants is discussed. The reports are about composing practice, specifically about how the participants treated the image differently in terms of musical elements or stylistic. Secondly, the responses from the participants in the individual interview on their perceptions of multimedia composition are discussed. Thirdly, the self-reflective journals written by the participants during the creative process are presented. These are concerned with problem-solving and decision-making. Finally, the observation of the participants’ MIDI files in composing strategies in the integration of visual stimuli and the musical treatments throughout their use of technology are discussed.
6.1 RESULTS OF THE ANALYSIS FROM THE WRITTEN REPORTS IN TASK TWO

Participants were asked to write about the design of the piece after they had finished the composition. Each participant submitted a written report on how they responded to the musical elements as evidence of their musical development regarding (1) theme, (2) harmony, (3) instrumentation, (4) texture, and (5) form. They were asked to compose two versions for the same movie or two different movies. The following data are presented for comparison to see how the participants use different musical styles to approach the same movie or two different movies. The rationale for making a comparison between two different versions is to observe how the participants approach different musical styles during the creative process of multimedia compositions. The movie is originally one-minute long and predesigned by the Associate Degree (Art and Design) students in the module “Multimedia Art” using Flash to produce the computer animation. The following data were derived from the written reports.
After examining the students’ written reports, it was noted that the first decision they made was whether to write a theme based on a scale or specific motive or selected pitches. Four of them considered the scale as their first decision in writing the theme. Students B, E, F, and H decided to use a specific scale. Students A, C, and G considered melodic lines or melodic motives as their first decision on writing the theme. Students D, J, and I considered harmony and style first when they started to compose. To summarize, the students tended to consider scales, modes, melodic motives as their first decision in writing the theme.
Table 6.2

2. Harmony

<table>
<thead>
<tr>
<th>Student</th>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12-measure blues progression</td>
<td>12-measure blues progression</td>
</tr>
<tr>
<td>B</td>
<td>Chromatic descending progression</td>
<td>Chromatic descending progression</td>
</tr>
<tr>
<td>C</td>
<td>i→IV/6/4→vii7→i→VI→V6→I</td>
<td>i→IV/6/4→vii7→i→VI→V6→I</td>
</tr>
<tr>
<td>D</td>
<td>Diminished scale progression</td>
<td>Minor scale progression</td>
</tr>
<tr>
<td>E</td>
<td>Same chord progressions in both</td>
<td>Same chord progressions in both</td>
</tr>
<tr>
<td></td>
<td>versions</td>
<td>versions</td>
</tr>
<tr>
<td>F</td>
<td>F→E7→F→E7→F→G7→A</td>
<td>Each phrase is using the same</td>
</tr>
<tr>
<td></td>
<td>G7→F→E7→F→G7→A</td>
<td>harmonic progression in different</td>
</tr>
<tr>
<td></td>
<td></td>
<td>keys: G minor→C minor→F minor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>→Bb minor.</td>
</tr>
<tr>
<td>G</td>
<td>i→iv→V7</td>
<td>i→iv→V7</td>
</tr>
<tr>
<td>I</td>
<td>Disco style</td>
<td>Heavy metal style with part A is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I→V→III→ii and part B is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VI→VII→I</td>
</tr>
<tr>
<td>J</td>
<td>Chromatic descending bass pattern</td>
<td>Diatonic ascending bass pattern</td>
</tr>
</tbody>
</table>

In Table 6.2, most of the students considered the harmonic progression in terms of harmony. Students A, C, D, E, F, G, H, I, and J wrote their composition based on a harmonic progression. Seven of them had planned a certain harmonic progression before they commenced. Student H used the same harmonic progression in both versions but modified them with different styles. Student J used a chromatic descending pattern and diatonic ascending pattern to create a harmonic contrast between the two different versions. Therefore, the use of harmonic progression was important and practical to the students’ creative process.
Table 6.3

3. Instrumentation

<table>
<thead>
<tr>
<th>Student</th>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Combo sections and brass sections</td>
<td>Combo sections</td>
</tr>
<tr>
<td>B</td>
<td>Strings, taiko drum, pad 2 (warm), synth voice, Hammond organ</td>
<td>Electric piano, orchestral harp, pad 2 (warm)</td>
</tr>
<tr>
<td>C</td>
<td>Chorused piano, flute, vibraphone, FX (rain, seashore, and ocarina)</td>
<td>Piccolo, oboe, English horn, clarinet, bassoon, French horn, trombone, tuba, marimba, string ensemble, cowbell, vibraslap, and triangle.</td>
</tr>
<tr>
<td>D</td>
<td>Soprano saxophone, accordion, acoustic bass, and bongo</td>
<td>Dulcimer, pan flute, shamisen, taiko, and kalimba</td>
</tr>
<tr>
<td>E</td>
<td>Seashore, harp, bird tweet, string ensemble, choir, cello, music box, soundtrack, and new age</td>
<td>Honky-tonk piano, harp, string ensemble, choir, cello, percussive organ, clarinet, FX brighten</td>
</tr>
<tr>
<td>F</td>
<td>String section</td>
<td>Strings section, woodwind section, and harp</td>
</tr>
<tr>
<td>G</td>
<td>Piano, bird R, bird L, voice oohs, koto, shamisen, guitar (nylon), FX2 (soundtrack) and strings</td>
<td>Pad 6 (metallic), music box, FX2 soundtrack, pad 2, Rhodes piano, seashore, lead, vibraphone, FX6 goblins, bass, and snare</td>
</tr>
<tr>
<td>H</td>
<td>Soundtrack, square, string ensemble, electric bass, fifths, atmosphere, reverse cymbal, and drums.</td>
<td>Distortion guitar, synth bass, string ensemble, choir aahs, guitar harmonics, helicopter, harp, reverse cymbal, and drums</td>
</tr>
<tr>
<td>I</td>
<td>Combo sections and marimba</td>
<td>Combo sections</td>
</tr>
<tr>
<td>J</td>
<td>Nylon guitar, piano, harpsichord, and harp</td>
<td>Two pipe organs</td>
</tr>
</tbody>
</table>

The possibilities of choosing instruments on a General MIDI patch list or sound modules made the creative process more flexible. It provided a lot of opportunities for students to experience the mixture of traditional orchestral instruments and electronic sounds at the same time. Students B, C, D, E, F, G, H, and J used different sets of instruments. Students A and I both used combo sections in the two versions. Students
C, E, G, and H, used some preset MIDI sound effects in the task, for example, Rain, Seashore, Bird, and Soundtrack, to describe the storyboard with visual images in the task.

Table 6.4

<table>
<thead>
<tr>
<th>Student</th>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Homophonic</td>
<td>Homophonic</td>
</tr>
<tr>
<td>B</td>
<td>Homophonic and Polyphonic</td>
<td>Homophonic</td>
</tr>
<tr>
<td>C</td>
<td>Homophonic</td>
<td>Homophonic and Polyphonic</td>
</tr>
<tr>
<td>D</td>
<td>Polyphonic</td>
<td>Homophonic</td>
</tr>
<tr>
<td>E</td>
<td>Homophonic and Polyphonic</td>
<td>Homophonic and Polyphonic</td>
</tr>
<tr>
<td>F</td>
<td>Polyphonic</td>
<td>Homophonic</td>
</tr>
<tr>
<td>G</td>
<td>Polyphonic</td>
<td>Polyphonic</td>
</tr>
<tr>
<td>H</td>
<td>Homophonic</td>
<td>Homophonic</td>
</tr>
<tr>
<td>I</td>
<td>Homophonic</td>
<td>Homophonic</td>
</tr>
<tr>
<td>J</td>
<td>Homophonic</td>
<td>Polyphonic</td>
</tr>
</tbody>
</table>

Five students approached the two versions differently in terms of texture. Students A, E, G, H, and I used the same texture in Version 1 and Version 2. Students B, C, D, F, and J used different textures in Version 1 and Version 2. These five students tried to experience different textures or a combination of both. The data revealed that different visual images might need different textures. This could trigger students’ problem-solving technique to compose the music in order to align the visual images with the music in the movie.
Table 6.5

5. Form

<table>
<thead>
<tr>
<th>Student</th>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Through-composed</td>
<td>Through-composed</td>
</tr>
<tr>
<td>B</td>
<td>Through-composed</td>
<td>Through-composed</td>
</tr>
<tr>
<td>C</td>
<td>AB (Binary)</td>
<td>AB (Binary)</td>
</tr>
<tr>
<td>D</td>
<td>Through-composed</td>
<td>Through-composed</td>
</tr>
<tr>
<td>E</td>
<td>Theme and Variations</td>
<td>Theme and Variations</td>
</tr>
<tr>
<td>F</td>
<td>ABA (Ternary)</td>
<td>AB (Binary)</td>
</tr>
<tr>
<td>G</td>
<td>Through-composed</td>
<td>Through-composed</td>
</tr>
<tr>
<td>H</td>
<td>ABA (Ternary)</td>
<td>AB (Binary)</td>
</tr>
<tr>
<td>I</td>
<td>ABA (Ternary)</td>
<td>Through-composed</td>
</tr>
<tr>
<td>J</td>
<td>Through-composed</td>
<td>Through-composed</td>
</tr>
</tbody>
</table>

Five students approached Task Two in a through-composed form. Students A, B, D, G, and J used the through-composed form to structure the piece. Students C, E, F, H, and I approached in the task in the ABA or AB form. It had a strong relationship with the storyboard of the visual images in the movie. The change of scenery in the movie could strongly affect the students’ perception of the organization of musical structure in Task Two. Therefore, the structure had a strong relationship with the alignment of the visual stimulus and musical accent. The relationship revealed that students had to consider both the structure of the movie and the structure of music at the same time.

To summarize the findings from the brief written reports, it was observed that students tended to consider scales, modes, melodic motives, and styles as their first decision in
writing the theme. Harmonic progression was important and practical to the students’ creative process. Furthermore, students used entirely different sets of instruments to match the style in Version 1 and Version 2 with some preset MIDI sound effects in the task, for example, Rain, Seashore, Bird, and Soundtrack, to describe the storyboard with visual images in the task. Moreover, synchronizing the visual images in the movie had a strong impact on the track-layering process in multimedia composition. Finally, the structure of the movie had a close connection with the structure of music, particularly in the process of aligning visual stimuli and musical accents in the task.

6.2 RESULTS OF THE ANALYSIS FROM THE INDIVIDUAL INTERVIEW IN TASK TWO

After finishing Task Two, individual interviews were conducted based on each student’s work. Interviews were held in which the participants described how they had worked and what thoughts had underpinned their actions. The focus of these interviews was on their activities, thoughts and considerations.

The questions for the interviews were divided into three categories: The first was about the visual thinking process. This included the consideration of how the students responded to the association of the visual image and musical ideas. The second category concerned music technology as the means of composing. This included considering how the students responded to the software markers, appropriate tempo, integrating audio and video, and musical style. The third category covered the musical thinking process. This included the students’ responses to problem-solving techniques, treatments of sync point, and the overall impression on multimedia composition.
In Table 6.6, the students’ responses to extramusical ideas are shown.

Table 6.6

Question 1: Do you think extramusical ideas can stimulate your composition?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes, I do think that extramusical ideas have a strong impact on the music compositions.</td>
</tr>
<tr>
<td>B</td>
<td>Yes, it can stimulate me to some extent. For example, some melodies formed in my mind when I was watching a movie.</td>
</tr>
<tr>
<td>C</td>
<td>I admit that extramusical ideas can stimulate my composition, but they also impose some restrictions on my composition.</td>
</tr>
<tr>
<td>D</td>
<td>Yes, they can.</td>
</tr>
<tr>
<td>E</td>
<td>Yes, I think that the extramusical ideas, such as images, can be stimulating. However, they also impose restrictions on my composition at a certain level.</td>
</tr>
<tr>
<td>F</td>
<td>Yes, especially the colours. From my viewpoint, white represents happiness and black represents a rather sad mood. Thus the music for movie 1 portrays a happy mood, and the music for movie 2 is sadder in mood.</td>
</tr>
<tr>
<td>G</td>
<td>Yes, because I get used to composing music based on the stories.</td>
</tr>
<tr>
<td>H</td>
<td>Yes, I think the moving of objects, the change of colours or scenes, etc. can stimulate composition.</td>
</tr>
<tr>
<td>I</td>
<td>Yes, what I see with my eyes and my feelings can stimulate my composition. Also, the stories can stimulate my composition a little bit.</td>
</tr>
<tr>
<td>J</td>
<td>Yes, I think some musical ideas are stimulated when I see the images.</td>
</tr>
</tbody>
</table>

All students agreed that extramusical ideas stimulated music composition. Student F stated that “especially the colours. From my viewpoint, white represents happiness and black represents a rather sad mood.” Student H claimed that, “I think the moving of objects, the change of colours or scenes, etc. can stimulate composition.” The change of colours could stimulate the mood and style of the composition. Student G stated, “I get used to composing music based on the stories,” and student I claimed that “the stories can stimulate my composition a little bit.” The storyboard could also
stimulate a composition. However, there were two students, C and E, who responded similarly that the visual images can be stimulating, but they also imposed the restrictions on my composition at a certain level.

In Table 6.7, the students’ responses to the association of the visual image and musical ideas are shown.

Table 6.7

Question 2: What did you think of the relationship between visual images and musical ideas?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I thought the musical ideas should fit the visual images.</td>
</tr>
<tr>
<td>B</td>
<td>The visual images by themselves could not tell the story completely, and the music could tell what the images couldn’t.</td>
</tr>
<tr>
<td>C</td>
<td>The music could bring out the messages of the visual images more clearly than the images themselves.</td>
</tr>
<tr>
<td>D</td>
<td>I thought both images and music could not be separated from each other because both of them expressed the same mood at the same time.</td>
</tr>
<tr>
<td>E</td>
<td>There was a close relationship between them. We would be bored if we watched the visual images without music; if we had listened to the music without any images to watch, we would not have been able to understand the music easily.</td>
</tr>
<tr>
<td>F</td>
<td>I thought that the image was related to the tempo of the music.</td>
</tr>
<tr>
<td>G</td>
<td>Both images and music were used to express people’s feelings, although in different ways.</td>
</tr>
<tr>
<td>H</td>
<td>I thought that there was a close relationship between them, since one could produce the images or movies after the music, and the composers could compose the music after the images or movies.</td>
</tr>
<tr>
<td>I</td>
<td>Both the images and music were media to express one’s feelings.</td>
</tr>
<tr>
<td>J</td>
<td>When I saw the images, some music might appear in my mind. When I listened to the music, some pictures might appear in my mind too.</td>
</tr>
</tbody>
</table>
All students agreed that the alignment between visual images and musical ideas was close. Student B stated that “The visual images by themselves could not tell the story completely, and the music could tell what the images couldn’t.” Student G claimed that, “Both images and music are the medium to express one’s feelings, although in different ways.” Student J said “When I saw the images, some music might appear in my mind. When I listened to music, some pictures might appear in my mind too.” Students D, G, I, and J agreed that both images and music could express human feelings. Students A and F thought that “the musical ideas should fit the visual images” and “the image was related to the tempo of the music.” This means that choosing an appropriate tempo was crucial in aligning the musical ideas and visual images.

In Table 6.8, the students’ responses to the objects associated with the visual images are shown.
Table 6.8

Question 3: How did you find the objects associated with the visual images?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I composed the musical ideas when I watched the movie.</td>
</tr>
<tr>
<td>B</td>
<td>I found that the associated objects enabled me to have more viewpoints on the visual images.</td>
</tr>
<tr>
<td>C</td>
<td>Actually, I couldn’t find any associated objects, but I associated the images with the modes, and I used the mode changes to show the contrast of the mood in the movie.</td>
</tr>
<tr>
<td>D</td>
<td>Actually, I found the associated mood, rather than associated objects.</td>
</tr>
<tr>
<td>E</td>
<td>Actually, I didn’t find any associated objects of the visual images, even with the movies used in the project.</td>
</tr>
<tr>
<td>F</td>
<td>I did find objects associated with the images, for example I used the trill to represent the birds.</td>
</tr>
<tr>
<td>G</td>
<td>I thought the associated objects helped me to get the feeling of the movies.</td>
</tr>
<tr>
<td>H</td>
<td>It was helpful in composing the music.</td>
</tr>
<tr>
<td>I</td>
<td>It depended on my feeling about the movie, and the associated objects helped me to get the feeling of the movie.</td>
</tr>
<tr>
<td>J</td>
<td>I found them just by my feeling for the images.</td>
</tr>
</tbody>
</table>

The purpose of the associated objects was to enable the researcher to ask the students to write down their associations of an object, feeling or mood with the visual images in their self-reflective journals. It was realized that the alignment between movie and music was actually the sync point in the movie and the musical accent in the composition. There were six students A, B, F, G, H, and I who found that the associated objects could actually enhance the association in music. Three students C, D and J even expanded into associating images with mood or associating images with modes.

In Table 6.9, the students’ responses to the storyboard are shown.
Table 6.9

Question 4: Did you build up a storyboard before you composed?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No, I didn’t build up any storyboard.</td>
</tr>
<tr>
<td>B</td>
<td>I built up a storyboard for Movie 1 before I composed. The storyboard talks about conquering of the world by the devil who was born from Image 9. I didn’t build the storyboard for Movie 2 when I composed the music.</td>
</tr>
<tr>
<td>C</td>
<td>No, I didn’t build up any storyboard.</td>
</tr>
<tr>
<td>D</td>
<td>Yes, I did.</td>
</tr>
<tr>
<td>E</td>
<td>No, because I didn’t see any linkages between the objects that appeared in the movies.</td>
</tr>
<tr>
<td>F</td>
<td>No I didn’t compose with any storyboard.</td>
</tr>
<tr>
<td>G</td>
<td>Yes, I did.</td>
</tr>
<tr>
<td>H</td>
<td>No, I didn’t think about that, but I was aware of the change of scenes.</td>
</tr>
<tr>
<td>I</td>
<td>Yes, I did.</td>
</tr>
<tr>
<td>J</td>
<td>No, because I wanted to express the confusion of the movie.</td>
</tr>
</tbody>
</table>

From the response, there were four students (B, D, G, and I) who built a storyboard before they composed. Student B stated, “I built up a storyboard for Movie 1 before I composed.” Six students (A, C, E, F, H, and J) did not build up a storyboard in composing. Student H claimed that, “I didn’t think about that, but I was aware of the change of scenes.” It implied that some students would like to express their feelings at first sight. The traditional way of teaching multimedia art was generally to build up a storyboard first. However, the storyboard was not a major factor during the creative process of multimedia composition at the composing stage.

In Table 6.10 students’ responses to mood are shown.
Table 6.10

Question 5: What kind of mood did you associate with the visual images?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Both versions were delightful in mood.</td>
</tr>
<tr>
<td>B</td>
<td>I associated a horrible, frightening mood in Movie 1, and a sad feeling, which was similar to the mood of the music <em>Hana's eyes</em> in Movie 2.</td>
</tr>
<tr>
<td>C</td>
<td>I associated the tranquility with version 1 (Movie 1) and I thought Version 2 (Movie 1) was full of life.</td>
</tr>
<tr>
<td>D</td>
<td>I associated calmness with Version 2 (Movie 1), while I associated more spirited, funny mood with Version 1 (Movie 1).</td>
</tr>
<tr>
<td>E</td>
<td>In Version 1 (Movie 1), I associated the natural, comfortable feeling with the visual images, and I associated the happiness and the hope with Version 2 (Movie 1).</td>
</tr>
<tr>
<td>F</td>
<td>I associated a lively, more positive mood in Movie 1; I associated a horrible atmosphere, just like in hell with Movie 2.</td>
</tr>
<tr>
<td>G</td>
<td>The mood I associated with was a darker mood, which was filled with confusion and deadly silence in Movie 2. I associated a peaceful mood with calmness in Movie 1.</td>
</tr>
<tr>
<td>H</td>
<td>I associated a mysterious mood with Version 1 (Movie 2) and a raw, industrial style with Version 2 (Movie 2).</td>
</tr>
<tr>
<td>I</td>
<td>I thought the mood in version 1 (Movie 2) was rigorous; I thought Version 2 (Movie 2) was portraying a sad emotion.</td>
</tr>
<tr>
<td>J</td>
<td>I associated the mood of confusion with both versions. In version 1 (Movie 1), I wanted to express a musical theme of confusion; in Version 2 (Movie 1), I stressed a feeling of confusion.</td>
</tr>
</tbody>
</table>

All 10 students had an association of mood in both versions. It revealed that the students preferred to use their imagination and intuitive thoughts to approach the task rather than accumulating a chain of sync points during the creative process. For example, Student F responded, “I associated a lively, more positive mood in Movie 1. I associated a horrible atmosphere, just like in hell in Movie 2.” Therefore, the association with mood played a vital role in the creative process of multimedia composition because the association of visual images could be a stimulus to the
overall mood of the movie.

In Table 6.11, the responses of the students to the software markers were shown.

Table 6.11
Question 6: Did you find the software markers helpful in composing during the creative process?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes, and they reminded me to stress certain points musically.</td>
</tr>
<tr>
<td>B</td>
<td>Yes, they reminded me to make special effects (musical accents) at some special points, for example the use of drum at the places where the “9” appeared.</td>
</tr>
<tr>
<td>C</td>
<td>I didn’t use many markers in my piece because I started with the overall mood of the movie first.</td>
</tr>
<tr>
<td>D</td>
<td>They helped me to stress some specific places.</td>
</tr>
<tr>
<td>E</td>
<td>Yes, they helped me to avoid the time lag between the movie and the music.</td>
</tr>
<tr>
<td>F</td>
<td>Yes, but I found that if the tempo, or the notes moved faster, the markers could fit the music more easily.</td>
</tr>
<tr>
<td>G</td>
<td>Yes, the names of the markers helped me to pay attention to the important point of the storyboard of the movies.</td>
</tr>
<tr>
<td>H</td>
<td>It helped me to figure out the structure of the music.</td>
</tr>
<tr>
<td>I</td>
<td>I thought it was not too important to me, but it was helpful to set the tempo of the music in the movie.</td>
</tr>
<tr>
<td>J</td>
<td>Yes, but I didn’t use it a lot since I couldn’t tackle it. When I encountered the point that I needed to adopt a compound time, I adopted 7/8 time, but I could not compose with it in the later section.</td>
</tr>
</tbody>
</table>

Nine students (A, B, D, E, F, G, H, I, and J) thought that the software markers were helpful especially for figuring out the tempo and structure of the piece. Student G claimed that “the names of the markers helped me to pay attention to the important point of the storyboard of the movies” and Student H stated, “It helped me to figure
out the structure of the music.”

In Table 6.12, the responses of the students to the tempo in the sequence are shown.

Table 6.12

Question 7: How would you determine the appropriate tempo in the sequence?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I thought that the appropriate tempo should be the one that fits most of the sync points on the downbeat.</td>
</tr>
<tr>
<td>B</td>
<td>I would find out a tempo that made most of the markers on the strong beat, and that tempo would become the <em>appropriate tempo</em>.</td>
</tr>
<tr>
<td>C</td>
<td>I determined the tempo of Version 1’s music with my first impression of the movie. However I decided the appropriate tempo of Version 2’s music depending on the musical style in which I composed.</td>
</tr>
<tr>
<td>D</td>
<td>I would determine the appropriate tempo by changing the tempo so that the markers were on the strong beat (the first and the third beat are the best in 4/4 time).</td>
</tr>
<tr>
<td>E</td>
<td>I would set the appropriate tempo that makes the markers on the strong beats.</td>
</tr>
<tr>
<td>F</td>
<td>Generally, I would set the tempo so that most of the sync points were on the downbeat.</td>
</tr>
<tr>
<td>G</td>
<td>I would change the tempo until most of the sync points were on the downbeat.</td>
</tr>
<tr>
<td>H</td>
<td>It depended on the length of the film. Also I thought the appropriate tempo should make the most of the syncs on the down beat, so I would change the tempo to fit the sync point.</td>
</tr>
<tr>
<td>I</td>
<td>I would watch the movie with the metronome to see if the tempo was suitable to the mood or not.</td>
</tr>
<tr>
<td>J</td>
<td>I got the tempo in my mind and try it on the computer, and changed the tempo until the important points are on the (down) beat.</td>
</tr>
</tbody>
</table>

Generally, all students found that setting the appropriate tempo in order to fit most of the sync points on the down beat or strong beat was useful in the creative process.
Student G claimed that, “I would change the tempo until most of the sync points were on the downbeat.” Student B stated, “I would find out a tempo that made most of the markers on the strong beat, and that tempo would become the *appropriate tempo.*” It revealed that the setting of the appropriate tempo was an important step to get the alignment between the visual images and music in digital film scoring.

In Table 6.13, the students’ responses to the integration of movie and music are shown.

### Table 6.13

*Question 8: Do you think the Sonar 3 software can integrate the movie and music at the same time?*

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes, I like the integration of movie and music in the software.</td>
</tr>
<tr>
<td>B</td>
<td>Yes, I think <em>Sonar 3</em> is user-friendly in the multimedia application.</td>
</tr>
<tr>
<td>C</td>
<td>Yes, I think the video clips and audio tracks synchronize accurately in the software.</td>
</tr>
<tr>
<td>D</td>
<td>Yes, the software can do so.</td>
</tr>
<tr>
<td>E</td>
<td>Yes, the export file of Sonar 3 can be improved into a direct MPEG compressed format.</td>
</tr>
<tr>
<td>F</td>
<td>Yes, the software is a great application of multimedia.</td>
</tr>
<tr>
<td>G</td>
<td>Yes, but with some restrictions. For example, the software cannot be sequenced with the multiple meter.</td>
</tr>
<tr>
<td>H</td>
<td>Yes, the software is user-friendly to PC user.</td>
</tr>
<tr>
<td>I</td>
<td>Yes, I agree with that.</td>
</tr>
<tr>
<td>J</td>
<td>Yes, I think so.</td>
</tr>
</tbody>
</table>

From the responses, all students agreed that the *Sonar 3* software could integrate the audio, MIDI and video at the same time. It showed music technology was an effective
tool to integrate the process of visualization and composing.

In Table 6.14, the responses of the students to the musical elements are shown.

Table 6.14

Question 9: Which musical elements did you consider the most important before you started to compose in this multimedia project?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I believed that the style was the most important element to decide before I composed and I chose the “blues” as my style for the project. Next was the instrumentation because the choice of the instruments affected the style greatly.</td>
</tr>
<tr>
<td>B</td>
<td>I thought the scale was the important element before I composed.</td>
</tr>
<tr>
<td>C</td>
<td>I thought the style was the most important before I composed, and the next was instrumentation.</td>
</tr>
<tr>
<td>D</td>
<td>The most important was the mood (style), and the next was the melody. I would consider the rhythm and the meter later on.</td>
</tr>
<tr>
<td>E</td>
<td>I thought that the style of the music was the most important element before I composed.</td>
</tr>
<tr>
<td>F</td>
<td>Firstly, I considered the instrumentation, then the accompanying rhythmic pattern.</td>
</tr>
<tr>
<td>G</td>
<td>Most important to me was the melody, next was the texture, and after the consideration of melody and texture, I would consider the harmony.</td>
</tr>
<tr>
<td>H</td>
<td>I thought the most important was the rhythm, and I could compose different melodies with the rhythms I chose; then the next was the harmony.</td>
</tr>
<tr>
<td>I</td>
<td>In Version 1, I considered the meter and the rhythm; in Version 2, I considered the mood and the instrumentation.</td>
</tr>
<tr>
<td>J</td>
<td>The melody was the most important, and the next was the harmony.</td>
</tr>
</tbody>
</table>

Students A, C, D, and E indicated that they considered musical style the most important decision in the task. Students B, F, G, H, I, and J considered other factors such as scale, melody, rhythm, meter, instrumentation to be the most important. The
musical elements such as texture and harmony were also considered in the creative process.

In Table 6.15, the responses of the students to musical style were shown.
Question 10: Did you have a particular musical style to fit the storyboard?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes, I adopted the “blues” style in my music.</td>
</tr>
<tr>
<td>B</td>
<td>Actually, I composed music with the storyboard, without any concern for style.</td>
</tr>
<tr>
<td>C</td>
<td>The music for Version 1 was composed in a pop style, and Version 2 was composed in a more classical way, with flute, ocarina instrumentation etc.</td>
</tr>
<tr>
<td>D</td>
<td>Both versions were my attempts to compose in other styles, rather than a classical style. I composed Version 1 in an Indian and Latin style and composed Version 2 in a more Japanese style.</td>
</tr>
<tr>
<td>E</td>
<td>The music for Version 1 was a romantic one which was filled with melodies. The style for Version 2 was lighter, and the tempo was faster.</td>
</tr>
<tr>
<td>F</td>
<td>I composed in the style of classical music.</td>
</tr>
<tr>
<td>G</td>
<td>In Movie 2, the style of the music was mysterious, and the music for Movie 1 was rather peaceful.</td>
</tr>
<tr>
<td>H</td>
<td>I composed Version 1 in an electronic style, which resembled the disco music of 1990s; Version 2 was industrial in style.</td>
</tr>
<tr>
<td>I</td>
<td>In Version 1, I composed in a rock style; in Version 2, I composed something similar to the soundtrack played by the instruments which had darker tone instrumental colours, such as harp and guitar.</td>
</tr>
<tr>
<td>J</td>
<td>For Version 1, I composed in a pop style. For Version 2, the style was more Baroque than Version 1 because I used two organs to play Preludes no. 1 (mutated to the minor) and no. 6 of J. S. Bach’s <em>Well-Tempered Clavier</em>, Book 1, simultaneously.</td>
</tr>
</tbody>
</table>

Nine students (A, C, D, E, F, G, H, I, and J) had particular musical styles in mind when they were composing. There was a good deal of diversification in musical styles, for example, Baroque, Classical, Jazz, Blues, Pop, Latin, Rock, electronic music, and so on. Seven students (C, D, E, G, H, I, and J) approached different moods or musical styles in Version One and Version Two. Student D claimed, “Both versions were my attempts to compose in other styles, rather than a classical style. I composed Version 1
in an Indian and Latin style and Version 2 in a more Japanese style.” Student H stated, “I composed Version 1 in an electronic style, which resembled the disco music of 1990s; the Version 2 was industrial in style.” To compose with music technology in multimedia composition was an effective tool to let the students gain experience in different musical styles. This led to an in-depth research study of the style traits that students were interested in exploring.

In Table 6.16, the students’ responses to the problem-solving technique are shown.
Table 6.16

Question 11: How did you solve the problem of the music sometimes not being in sync with the visual images?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I amended the melodies of the sync points, so that they could fit the sync points.</td>
</tr>
<tr>
<td>B</td>
<td>I composed a new piece completely because I think it’s quite difficult to partially revise the piece, and make the revised part coordinated in style with the other parts.</td>
</tr>
<tr>
<td>C</td>
<td>I amended the rhythm at the places where the music was not in sync; sometimes I would also amend the melodies.</td>
</tr>
<tr>
<td>D</td>
<td>I made another version with different melodies, to fit the images of the movie.</td>
</tr>
<tr>
<td>E</td>
<td>I deleted the melodies which were not in sync, and compose another melody to fit the markers.</td>
</tr>
<tr>
<td>F</td>
<td>Actually, I didn’t encounter this problem at all.</td>
</tr>
<tr>
<td>G</td>
<td>I deleted the whole section which was not in sync with the images, and compose a new one.</td>
</tr>
<tr>
<td>H</td>
<td>I changed the tempo to make the music in sync with the images.</td>
</tr>
<tr>
<td>I</td>
<td>In Version 1, I would delete those sync points not in sync with the visual images. I would change the phrasing to fit the sync points too. I would also tackle it by the conversion of the time of the movie and the number of measures.</td>
</tr>
<tr>
<td>J</td>
<td>I treated it in three ways: (1) change the tempo; (2) correct, or delete and recompose the section; or (3) ignore the problem, and leave the music out of sync with the movie.</td>
</tr>
</tbody>
</table>

From the responses, students dealt with the problem when the music was not in sync with the visual images in the following ways:

1. made amendments of the rhythm, melody, instrumentation, texture, and form.
2. changed the length of the musical phrase
3. changed the tempo
4. corrected or deleted and recomposed the section
5. composed a new piece completely.

The above solutions revealed that problem-solving techniques were crucial in multimedia composition. The integration of visual stimuli and musical accents required advanced levels of creativity in music, critical thinking skills, and musical thinking skills.

In Table 6.17 the students’ responses to the sync point are shown.
Table 6.17

Question 12: How did you treat the sync point musically?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I did it in two ways: (1) I would compose a high-pitched passage as the “9” appears at the higher level in the movie, and the lower pitched notes when the “9” falls down; (2) I would make the dynamic changes on the sync points.</td>
</tr>
<tr>
<td>B</td>
<td>I made changes to the various musical elements, for example the dynamics, rhythm, texture, etc.</td>
</tr>
<tr>
<td>C</td>
<td>Actually, I made no changes at the sync point of Version 1’s music, but I made some changes at the sync points of the Version 2 music, for example the use of scale passages to show the movement of the object in the movie.</td>
</tr>
<tr>
<td>D</td>
<td>Sometimes the melodies entered or disappeared at the sync points, and sometimes I didn’t treat it at all.</td>
</tr>
<tr>
<td>E</td>
<td>I changed the dynamics, or write an ascending or descending scale passage to fit the movement of the objects in the movies.</td>
</tr>
<tr>
<td>F</td>
<td>I did not add the special music effects, such as the sudden ringing of the bells, and many others; I would give special treatments to the phrasing of the melodies so that the sync points could be brought out, like the entry of the melodies at the sync points.</td>
</tr>
<tr>
<td>G</td>
<td>I did it in a few ways: (1) changing the harmonic progression; (2) using the percussion instruments; (3) using arpeggios to show the flight of the bird.</td>
</tr>
<tr>
<td>H</td>
<td>In Version 1, I entered the main melody at the sync point; in Version 2, I made a thicker texture and changed the harmonic progression.</td>
</tr>
<tr>
<td>I</td>
<td>I treated it by the change of the meter.</td>
</tr>
<tr>
<td>J</td>
<td>I added the ninth chord to synchronize the image, 9, in the movie.</td>
</tr>
</tbody>
</table>

From the responses, the treatment of the sync points could be classified in the following ways:

1. the change of meter, register, pitch, rhythm, harmony, dynamics, and texture
2. the use of ascending, descending diatonic or chromatic scale and arpeggio passages
3. the use of musical phrases, and
4. the use of percussion instruments.

The above musical treatment of the sync point showed that the intermedia relationships between visual images and music. The use of different musical elements or musical phrases requires a decision-making process on the musical accent and how to treat the visual image musically. The choices of different instruments were mentioned in the interview.

The musical treatment of the visual stimuli was a great challenge in composing for the media. The *mickey-mousing* technique in film scoring required a vast amount of time to apply different musical elements to chase the action of the visual images in order to integrate the visual image and music. From the responses, most of the students tackled this issue by changing the use of musical elements such as scales, arpeggios, or phrases. Student G found that the use of percussion instruments could be an effective way to synchronize the picture. Therefore, the use of different instrumentation and orchestration can be considered as a musical treatment to the visual images.

In Table 6.18, the students’ responses to the musical accent are shown.
Table 6.18

Question 13: Do you think a musical accent can emphasize the sync point in the movie?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes, I think the <em>Sonar</em> marker is quite useful.</td>
</tr>
<tr>
<td>B</td>
<td>Yes, it can accent the sync point more directly.</td>
</tr>
<tr>
<td>C</td>
<td>Yes, it can emphasize the sync point. However, because I used <em>Finale</em>, it couldn’t match the visual movement exactly. So I think I can emphasize the sync point more clearly with the <em>Sonar</em> software.</td>
</tr>
<tr>
<td>D</td>
<td>Yes, I think so.</td>
</tr>
<tr>
<td>E</td>
<td>Yes, I agree that the accents can stress those sync points.</td>
</tr>
<tr>
<td>F</td>
<td>Yes, I think so.</td>
</tr>
<tr>
<td>G</td>
<td>Yes, I think so.</td>
</tr>
<tr>
<td>H</td>
<td>Yes, I think so.</td>
</tr>
<tr>
<td>I</td>
<td>I think the software markers can remind me to pay more attention to the sync point.</td>
</tr>
<tr>
<td>J</td>
<td>Yes, it works in Version 1, and makes fewer musical accents in Version 2 because I create a mixture of two different Bach preludes, and it is difficult to add the musical accents. Also, the counterpoint of those melodies created the necessary confusion.</td>
</tr>
</tbody>
</table>

All participants agreed that the use of musical accents could emphasize the visual stimuli in the task. The responses revealed that the alignment of visual images and music was involved in visualizing and musical thinking during the creative process of the multimedia composition. The use of markers in *Sonar* was an effective way to teach students to put musical accents at the sync points of the movie.

In Table 6.19, the students’ responses to the limitations of music technology are shown.
Table 6.19

Question 14: What are the limitations of music technology in this Creative Multimedia Music Project?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The number of the instruments in the patch list should be increased.</td>
</tr>
<tr>
<td>B</td>
<td>The greatest barrier in composing with music technology is the function of panning. It would be much better if this function could produce the surround-sound effect.</td>
</tr>
<tr>
<td>C</td>
<td>The sound quality of the sound module should be improved, and Sonar 3 could be improved so that it would be more user-friendly.</td>
</tr>
<tr>
<td>D</td>
<td>The main one is the differences in the sound produced by different hardware and workstations.</td>
</tr>
<tr>
<td>E</td>
<td>Firstly, the hardware is too expensive. Also, it is not an easy task for me to learn the skills of music technology in composing.</td>
</tr>
<tr>
<td>F</td>
<td>The sound quality of the module is the main limitation in this project.</td>
</tr>
<tr>
<td>G</td>
<td>There are too few choices of instruments in the sound module.</td>
</tr>
<tr>
<td>H</td>
<td>I was restricted by the movie. Also, the quality of the hardware, especially the sound card, should be improved. Besides, it would help me a great deal if there were a guitar interface, and the audio guitar could be recorded and edited with the MIDI instruments.</td>
</tr>
<tr>
<td>I</td>
<td>The sound quality of the sample could be improved.</td>
</tr>
<tr>
<td>J</td>
<td>Some software is not compatible with others, like Sonar 3 with Finale.</td>
</tr>
</tbody>
</table>

From the responses it emerged that students were suggesting the following points to solve the limitations in music technology:

1. Improving the sound quality of the samples
2. Increasing the number of instruments and patch lists
3. Integrating the notation and sequencing software, and
4. Lowering the price of software and hardware in music technology.

From the students’ perspective, the choice of instruments should be expanded with the software synthesizer. The notation of the sequencing software could be improved so
that the integration between notation and sequencing software became possible.

In Table 6.20, the students’ responses concerning their overall impression of this project are shown.
### Table 6.20

Question 15: What is the overall impression of this project? Will you compose with technology after finishing this project?

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>It is a new, interesting course that allows me to compose with technology for the first time. I will compose with it in the future because it is more convenient than the conventional method (composing with pencil and paper).</td>
</tr>
<tr>
<td>B</td>
<td>Music technology helps me to compose. I will compose with music technology after this project.</td>
</tr>
<tr>
<td>C</td>
<td>The project is meaningful because I can learn to use different sequencing and notation software, although the recording technique is quite difficult to learn. I think I will compose with technology, especially the notation software, after finishing the project.</td>
</tr>
<tr>
<td>D</td>
<td>It is a new and interesting project, but we have too little time to use it. I think I will use the technology after this, even study it, if I can use a well-equipped music technology laboratory.</td>
</tr>
<tr>
<td>E</td>
<td>This project enables me to learn things such as using the sequencing software. I will compose with technology in the future.</td>
</tr>
<tr>
<td>F</td>
<td>I have to admit that the tempo setting is very difficult, but I will continue to compose with technology in the future.</td>
</tr>
<tr>
<td>G</td>
<td>It is a good way to express myself, but the musical content of style could be further discussed in the module. I will continue to compose with technology.</td>
</tr>
<tr>
<td>H</td>
<td>It is an interesting introductory course. I will compose with it in the future.</td>
</tr>
<tr>
<td>I</td>
<td>It is a practical course, although it is quite time consuming to bring the music and the sync point together. I will compose this way because I can produce the sounds of instruments that I cannot play in reality.</td>
</tr>
<tr>
<td>J</td>
<td>It is a convenient alternative way of composing, although the reality of the sound is not good. I will compose with technology later on after finishing this project.</td>
</tr>
</tbody>
</table>

Most of the students made encouraging and positive responses to the use of music technology in the Creative Multimedia Music Project. All of them indicated that they
would continue composing with technology in the future and the students were satisfied with the content of the module. Student G suggested that “the musical content of style could be further discussed in the module.” Student I expressed the view that, “It is a practical course, although it is quite time consuming to bring the music and the sync point together. I will compose in this way because I can produce the sounds of instruments that I cannot play in reality.”

6.3 RESULTS OF THE ANALYSIS FROM THE SELF-REFLECTIVE JOURNAL IN TASK TWO

In this section, the findings of the bi-weekly journal are presented to verify the problem-solving techniques and decision-making process during the creative stage. The following tables illustrated the inspirations of the piece, issues and problems that were encountered, and the issues in using music technology to compose. The findings of the journal provided some of the thoughts and insights of the participants when they were using music technology to compose. This information particularly gave another perspective to the composing strategies of the participants as reflective practitioners.

Since some of the collected data did not fit into the categories, some information might be irrelevant to the current research in the journals. The same rationale was adopted as in Task One—Computer-Assisted Composition. The irrelevant information was omitted because the researcher could not force the information into the matrix if it did not fit into the categories.
Table 6.21

Inspirations

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>V.1 Soundtrack – Horror movie</td>
</tr>
<tr>
<td></td>
<td>V.2 Soundtrack – Maksim</td>
</tr>
<tr>
<td>C</td>
<td>V.1 Song</td>
</tr>
<tr>
<td></td>
<td>V.2 Melody</td>
</tr>
<tr>
<td>D</td>
<td>V.1 Latin &amp; African music</td>
</tr>
<tr>
<td></td>
<td>V.2 Japanese music</td>
</tr>
<tr>
<td>E</td>
<td>V.1 Melody</td>
</tr>
<tr>
<td></td>
<td>V.2 Melody</td>
</tr>
<tr>
<td>F</td>
<td>V.1 Rhythm</td>
</tr>
<tr>
<td></td>
<td>V.2 Classical music</td>
</tr>
<tr>
<td>G</td>
<td>V.1 Bird sound</td>
</tr>
<tr>
<td></td>
<td>V.2 Music Box</td>
</tr>
<tr>
<td>H</td>
<td>V.1 Colour of the image</td>
</tr>
<tr>
<td></td>
<td>V.2 Contrast of the image</td>
</tr>
<tr>
<td>I</td>
<td>V.1 Progressive style</td>
</tr>
<tr>
<td></td>
<td>V.2 Regressive style</td>
</tr>
</tbody>
</table>

In Table 6.21, it is interesting to observe the inspirations for the two versions. The rationale for asking the students to compose two versions with the same movie was to develop their skills at thinking divergently in creative thinking. There was no suggested answer or model answer to write music for the video. It had to do with the similarities and differences tests mentioned in the framework of multimedia composition by Cook (1996).
Table 6.22

Issues / Problems Encountered

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>V.1 Lack of continuity between sections</td>
</tr>
<tr>
<td></td>
<td>V.2 Music cannot match sync points exactly</td>
</tr>
<tr>
<td>C</td>
<td>V.1 Music cannot match sync points exactly</td>
</tr>
<tr>
<td></td>
<td>V.2 Lack of time</td>
</tr>
<tr>
<td>D</td>
<td>V.1 Complicated rhythm</td>
</tr>
<tr>
<td></td>
<td>V.2 Slow tempo</td>
</tr>
<tr>
<td>F</td>
<td>V.1 Instrumentation and texture</td>
</tr>
<tr>
<td></td>
<td>V.2 Orchestration</td>
</tr>
<tr>
<td>G</td>
<td>V.1 Spatial effect</td>
</tr>
<tr>
<td></td>
<td>V.2 Spatial effect</td>
</tr>
<tr>
<td>H</td>
<td>V.1 The texture could not match the length of the video</td>
</tr>
<tr>
<td></td>
<td>V.2 Change musical form</td>
</tr>
<tr>
<td>I</td>
<td>V.1 Suitable tempo</td>
</tr>
<tr>
<td></td>
<td>V.2 Slower tempo</td>
</tr>
</tbody>
</table>

Table 6.22 shows that students B, C, H, and I mentioned that the music could not match the sync points exactly as an identified issue. This confirmed the findings from the semi-structured interviews with the individual students. Most of them used the tempo to shift the time frame to fit the downbeat of the music as a musical accent.
Table 6.23

*Issues about Music Technology*

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
</table>
| B       | V.1 Chromatic descending scales to fit the falling down image  
          V.2 Framework of story board as a skeleton |
| D       | V.1 Percussion bongos was added  
          V.2 Long notes in order to fit the style |
| F       | V.1 Use piccolo to fit the image  
          V.2 Use strings, staccato to fit the images |
| G       | V.1 Use percussion to fit the images  
          V.2 Use percussion to fit the images |
| I       | V.1 Use percussion to fit the images  
          V.2 Use harp arpeggios to fit the images |

In Table 6.23, the findings from the issues in music technology provide a couple of solutions to the problems encountered. Student B used a descending scale to fit the image to solve the problem of the lack of continuity. Student D used bongos to play complicated rhythms which were inspired by Latin and African music. Also, she used long notes to fit the style and slow tempo to fulfill the inspiration of Japanese music. Student I used percussion to fit the images with a suitable tempo that aligns with the images to fulfill the inspiration of a *progressive style*. Also, he used harp arpeggios to fit the images with a slower tempo to fulfill the inspiration of a *regressive style*. 
6.4 RESULTS OF THE ANALYSIS FROM THE MIDI FILE OBSERVATION IN TASK TWO

In this section, the screens of MIDI tracks were used to demonstrate the development of the students’ thinking process. In Task Two, the MIDI tracks were observed with particular reference to how visual images affected the musical elements in the composition, such as texture, instrumentation, the development of the theme, harmonic progression and form. All of these elements were discussed in the written report. The demonstrations of Version 1 and Version 2 were to show the different musical treatments given to the visual images of the participants. The linkage between the two files was observed and the connection with other data sources was discussed. The compositions of the 10 participants are attached in Appendix IX—CD-Rom Two (Creative product of Task Two—Multimedia Composition).

Student A (Version 1)

![Image of Student A (Version 1) — Markers view of the visual images.](image)

*Figure 6.1 Student A (Version 1)—Markers view of the visual images.*
Figure 6.2 Student A (Version 1)—Musical treatment of the visual images.

Student A used a 12-measure blues progression as the basic harmonic structure of Version 1. She used brass instruments with minor seventh arpeggios to hit the sync point of the last three no. 9 images. She applied a musical phrase to treat the images.

**Student A (Version 2)**

![Figure 6.3 Student A (Version 2)—Markers view of the visual images.](image)

Figure 6.3 Student A (Version 2)—Markers view of the visual images.
Student A used the same 12-measure blues progression in Version 2. The bass line changed from eighth notes to sixteenth notes. She has used the sounds Gunshot and Synth Pad to synchronize the last three no.9 images. She applied Sound Effect to treat the images. The two versions demonstrated that she used two different approaches to solve the last three markers for the same images.

**Student B (Version 1)**

<table>
<thead>
<tr>
<th>Hr:Min:Sec.Fr</th>
<th>Lk</th>
<th>M.B.T</th>
<th>Pitch</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00:00:10</td>
<td></td>
<td></td>
<td></td>
<td>Appear</td>
</tr>
<tr>
<td>00:00:00:12</td>
<td></td>
<td>3:03:066</td>
<td>Move down</td>
<td>Appear again</td>
</tr>
<tr>
<td>00:00:10:22</td>
<td></td>
<td>5:02:067</td>
<td>Move up</td>
<td>Move down</td>
</tr>
<tr>
<td>00:00:13:16</td>
<td></td>
<td>6:02:168</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:16:27</td>
<td></td>
<td>7:04:061</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:20:09</td>
<td></td>
<td>12:01:026</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:27:09</td>
<td></td>
<td>15:02:178</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:37:03</td>
<td></td>
<td>15:04:187</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:40:20</td>
<td></td>
<td>17:02:143</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:49:15</td>
<td></td>
<td>21:01:004</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:54:06</td>
<td></td>
<td>22:04:119</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:56:25</td>
<td></td>
<td>23:04:163</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:00:59:04</td>
<td></td>
<td>24:04:115</td>
<td>Move up</td>
<td>Move up</td>
</tr>
<tr>
<td>00:01:00:13</td>
<td></td>
<td>25:03:004</td>
<td>Move up</td>
<td>Move up</td>
</tr>
</tbody>
</table>

*Figure 6.5 Student B (Version 1)—Markers view of the visual images.*
Figure 6.6 Student B (Version 1)—Musical treatment of the visual images.

Student B used the C minor key in both versions. She applied the bass drum to synchronize the images of appearance and reappearance as an introduction to the movie. The two organs in left and right speakers weave with the bird’s wings. The string line moves in a chromatic scale to match the falling down image and then changed to bird again. She has therefore applied a musical phrase to fit the images into Version 1.
In Version 2, student B applied the same panning idea in the two piano parts with the left and right channels. It is written in C minor. The similarities are the ideas of the keyboard parts in both versions. The main differences are the musical treatment of the visual images. She used harp arpeggios to fit the marker in Version 2, but version 1 did not.
Student C (Version 1)

Figure 6.9 Student C (Version 1)—Musical treatment of the visual images.

Student C did not use any markers in Task Two. Therefore, no markers view was provided for analysis in this occasion. She tended to compose with the overall mood and style as her composing strategy, as stated in the interview. This kind of recording is called wild—a cue is recorded without clicks, punches, streamers or the use of a clock as discussed in the literature review in chapter 3.

Student C (Version 2)

Figure 6.10 Student C (Version 2)—Musical treatment of the visual images.

In Version 2, she attempted to use orchestral instruments in a classical style to fit the
movie. Again, she used wild to synchronize the images. The advantage of using wild is to provide more room for the composer to write in different styles. The disadvantage is that the connection and linkage between images and music become looser.

Student D (Version 1)

![Figure 6.11 Student D (Version 1)—Markers view of the visual images.](image)

![Figure 6.12 Student D (Version 1)—Musical treatment of the visual images.](image)

Student D used different instruments in Task Two. Version 1 is in an African style with bongos and acoustic bass as identified in the written report. The acoustic bass part was played to synchronize with the visual images of several markers, for example, black jing ji, birds hope tei, and bird eats leaves.
In Version 2, she used more Japanese instruments in the sequence, for example, the Pan flute, shamisen, and taiko. The taiko part was played to synchronize with the visual images of several markers, for example, *leave gone*, *nine rebound*, and *beautiful flower*. In both versions, she used either a bass or percussion instruments to build the bridges between visual images and music.
Student E (Version 1)

![Marker view of the visual images.](image1)

**Figure 6.15** Student E (Version 1)—Markers view of the visual images.

![Musical treatment of the visual images.](image2)

**Figure 6.16** Student E (Version 1)—Musical treatment of the visual images.

Student E used the two markers to structure the piece. The trombone line was used to synchronize the visual image of *tree in*. The string ensemble line was used to synchronize with the visual image of *bird in*. The overall texture placed emphasis on the layering of instruments.
In Version 2, the honky-tonk piano was used to synchronize the visual images of *tree in* and the trombone was used to synchronize the visual images of *bird in*. Both versions used the same chord progression.
Student F (Version 1)

Figure 6.19 Student F (Version 1)—Markers view of the visual images.

<table>
<thead>
<tr>
<th>Hi:Min:Sec</th>
<th>Lk</th>
<th>MB:Pitch</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00:01:23</td>
<td></td>
<td>1:34:342</td>
<td>Dot</td>
</tr>
<tr>
<td>00:00:04:07</td>
<td></td>
<td>3:01:042</td>
<td>Dot</td>
</tr>
<tr>
<td>00:00:06:06</td>
<td></td>
<td>3:04:689</td>
<td>Dot</td>
</tr>
<tr>
<td>00:00:10:23</td>
<td></td>
<td>6:31:438</td>
<td>Inverted 9</td>
</tr>
<tr>
<td>00:00:20:08</td>
<td></td>
<td>10:03:466</td>
<td>Fruit 9</td>
</tr>
<tr>
<td>00:00:27:15</td>
<td></td>
<td>14:31:240</td>
<td>Flyout</td>
</tr>
<tr>
<td>00:00:28:02</td>
<td></td>
<td>14:32:314</td>
<td>Flyin</td>
</tr>
<tr>
<td>00:00:31:08</td>
<td></td>
<td>15:04:350</td>
<td>Pigeon</td>
</tr>
<tr>
<td>00:00:32:26</td>
<td></td>
<td>16:03:429</td>
<td>Flower with 9</td>
</tr>
<tr>
<td>00:00:40:03</td>
<td></td>
<td>20:01:192</td>
<td>Flower</td>
</tr>
<tr>
<td>00:00:45:15</td>
<td></td>
<td>22:03:432</td>
<td>Leaf with Bird</td>
</tr>
<tr>
<td>00:00:47:15</td>
<td></td>
<td>23:03:240</td>
<td>Leaf with Bird 2</td>
</tr>
<tr>
<td>00:00:50:15</td>
<td></td>
<td>24:34:912</td>
<td>Bird flyout</td>
</tr>
</tbody>
</table>

Figure 6.20 Student F (Version 1)—Musical treatment of the visual images.

Student F used pizzicato strings to synchronize with the first three images of *dot* and adding the woodwind quartet to the string quartet to synchronize with the *pigeon fly out*. The composing strategy is an association of the storyboard with different textures and instrumentations to express the meaning of the images.
In Version 2, it seemed that there were many sync points in the marker view. Student F used a similar composing strategy in Version 1. It was about the association of the storyboard with different textures and instrumentations to express the meaning of the
Student G (Version 1)

Figure 6.23 Student G (Version 1)—Markers view of the visual images.

Figure 6.24 Student G (Version 1)—Musical treatment of the visual images.

Student G used the Chinese language to describe the association of the images. He built his own storyboard to connect the images. Most of the instruments are computer-generated sounds. The three patches were used to synchronize with the first
three markers, *Anybody home?*

**Student G (Version 2)**

*Figure 6.25 Student G (Version 2)—Markers view of the visual images.*

*Figure 6.26 Student G (Version 2)—Musical treatment of the visual images.*

In Version 2, student G used a similar approach to synchronize the visual image in Task Two. He used the drum pattern to reinforce the visual image, *the evil appears.*
Student H (Version 1)

![Figure 6.27](image1)

*Figure 6.27* Student H (Version 1)—Markers view of the visual images.

![Figure 6.28](image2)

*Figure 6.28* Student H (Version 1)—Musical treatment of the visual images.

Student H used a string line with long notes to synchronize the visual image, *circle expand*, and the synthesizer pad did an accelerando to match the reappearance of the visual images, *return*. Also, the string line imitated the drawing line of the images, *bird’s wings*, so as to resemble the gesture of the images. To observe the composition
trend, student H leaned towards the *techno* style in Version 1 as stated in the written report.

**Student H (Version 2)**

*Figure 6.29* Student H (Version 2)—Markers view of the visual images.

*Figure 6.30* Student H (Version 2)—Musical treatment of the visual images.

Student H used the *analog synth* sound to synchronize with the visual image, *circle expand*, and a string ostinato to synchronize with the visual image, *no. 9*. The electric bass line solo was used to synchronize with the visual images, *wings*. The cymbal crescendo was used to emphasize the reappearance of the *no. 9* in the visual image,
To observe the composition trend, Student H leaned towards a rhythmic pattern in rock style and ostinato as his main compositional devices in Version 2.

**Student I (Version 1)**

*Figure 6.31* Student I (Version 1)—Markers view of the visual images.

*Figure 6.32* Student I (Version 1)—Musical treatment of the visual images.

Student I used a ride cymbal to set the swing pattern to the image, *bird in*, without exact synchronization. The combo section came in to synchronize with the visual image, *drop*. Gunshot was used to synchronize with the visual image, *shot*, and the
use of the organ to echo the death of the bird. The choir was used with a ii6, V, I chord progression to synchronize the visual image of *ending*. The use of the spatial effect of three marimbas in left, middle, and right was written in a polyphonic texture.

**Student I (Version 2)**

![Figure 6.33 Student I (Version 2)—Markers view of the visual images.](image)

*Figure 6.33 Student I (Version 2)—Markers view of the visual images.*

![Figure 6.34 Student I (Version 2)—Musical treatment of the visual images.](image)

*Figure 6.34 Student I (Version 2)—Musical treatment of the visual images.*

It matched the findings from the written report of the progressive style in Version 1 and the regressive style in Version 2. With the same marker, the tempo of Version 2 was twice as slow as that in Version 1. The harp was used to set up the mood of sadness. The choir was used to synchronize with the visual image called *transform*. Timpani was used to synchronize with the image, *splash*, and the music box was used
to recapitulate the ideas of sadness to synchronize with the visual image, *again*.

**Student J (Version 1)**

Figure 6.35 Student J (Version 1)—Musical treatment of the visual images.

Since Student J did not use any markers in Task Two, no markers view was provided for analysis in this occasion. Although Student J did not put any markers in the sequence, the structure of the piece was defined clearly from the use of instruments and musical ideas. From the written report, Student J mentioned that the 9th chord was played with an acoustic guitar to resemble the visual image, *no. 9*, on purpose. With the visual image, *tree grows*, he used diminished chord as an arpeggio pattern to resemble the gesture of the images. The harpsichord was used to synchronize with the image, *the bird flies*. Since the markers were not in use, the exact timing was not accurate in the alignment between visual images and music.

**Student J (Version 2)**

Figure 6.36 Student J (Version 2)—Musical treatment of the visual images.
Student J used two church organs to play a triplet in the right channel and a duplet in the left channel to resemble the chaotic atmosphere as stated in the self-reflective journal. He also applied the mixing and panning function in blending two organs as a surround sound effect.

6.5 SUMMARY OF FINDINGS FROM MIDI FILE OBSERVATION

The above MIDI file observation confirmed some of the findings from the written reports, journals and interviews. Across the 10 participants, it was difficult to generalize a particular composition strategy that could be used as an approach to Task Two—Multimedia Composition. In chapter 3, Webster (2003) suggested that creating a wide variety of timbral effects, spatial distance and textural diversity can be manipulated easily with the technological support. From the MIDI observation it was found that, in using music technology to compose with movie and music, the software and hardware could integrate the creative process, especially the musical elements, such as spatial effects, timbre changes, and textural diversity. The pedagogical approach of asking the students to compose for two different versions in the same movie engaged the divergent and convergent thinking of the students. Webster (2003) suggested a set of skills which allowed for the thinking process to occur. One was convergent thinking skills and the other was divergent thinking skills. Convergent thinking skills were the ability to recognize rhythmic and tonal patterns and musical syntax. Divergent, imaginative skills were critical and included musical extensiveness, flexibility, and originality. From the MIDI file observation, the participants were able to manipulate and demonstrate these skills through the creative process.

From the findings, two kinds of composing practice were observed across these 10
participants in using music technology to compose as follows:

In Figure 6.37, the composer continuously switched between two perspectives: synchronizing-composing and associating-composing in multimedia composition. This method of working was based on the possibility of separating procedures: visualizing, synchronizing, associating, composing, and editing. In the first category, the music was often more aligned and structured. Usually, chains of specific markers were included in the composition to fulfill the exact alignment between visual images and music. In the second category, the music was often more contextualized and intuitive. Usually, it depended on the composer’s intuition, thoughts, mood, or feelings about the visual images. The composer continuously worked out the creation of shifting between these two categories during the creative process in multimedia composition.
CHAPTER 7
ANALYSIS OF THE DATA

This chapter is divided into five sections. The first section contains profiles of each participant responding to research questions 1, 2, and 3. The second section includes the analysis of four data sources. These descriptions are focused on the commonalities of the processes exhibited in each task. Following these descriptions is a discussion of the patterns that emerged as a result of the analyses of research questions 1, 2, and 3. The third section presents the developmental patterns that emerged from the analysis with the adaptation of Webster’s creative thinking model in response to research question 4. The fourth section discusses the findings from the developmental patterns relating to the review of literature from chapter 2. The last section compares the similarities and differences in the creative process of computer-assisted composition and multimedia composition.

7.1 RESPONDING TO RESEARCH QUESTIONS 1, 2, AND 3

In this section, data relating to research questions 1, 2, and 3 are presented and interpreted within the individual profiles of each student. The findings are presented as a progression of how each participant responded to each task from four data sources. Research question 1 is divided into two parts: Part A is related to Task One and Part B is related to Task Two.

Student A: W. K. Kom

Research question 1a: In the creative process of computer-assisted composition, she wrote her six-measure theme in G minor based on a chord progression with four
instruments—strings, clarinet and horns, and oboe—using theme and variation techniques. She mainly composed with the *Finale* music notation software. For her the most important musical element was harmony. With the harmonic progression, she developed the melody as a motive. Then she considered the texture. The inspiration came from a harmonic progression. She planned to compose a piece in a classical style, resembling Beethoven. She regarded the music as complete after reaching the climax.

**Research question 1b:** In the creative process of multimedia composition, she started with a melodic bass line in Version 1 and a melodic sound effect in Version 2 based on a 12-measure blues progression with combo sections in a homophonic texture and through-composed form. She used different compositional approaches with different musical styles in these two versions.

**Research question 2:** Kom responded that using *Finale* on the computer was easier than using *Sonar* because she could listen to the sound almost instantly, and then she could think about the composition further and make changes quickly. She chose the instrumentation aurally then tried it on the sound module, and listened to the sound to establish whether it was suitable. She typed the music into *Finale*, and listened to it to check whether it was good or not. The quantization function was good, when it was applied to the making of the rhythm section. However, it did not apply to the making of the melodies because it made the rhythm too accurate and not humanized. The mixing and panning function was useful since it helped her make a surrounded sound effect. She thought that the music technology could help transform the preliminary ideas into the actual sound and the computer workstation was good enough to compose with music technology.
Research question 3: She responded that extramusical ideas could stimulate her composition and the musical ideas should fit the visual images. She associated the visual images with the musical ideas when she watched the movie. Two versions were delightful in mood and the software markers reminded her to musically stress certain points. She agreed that the software can integrate the movie and music at the same time, and the style is the most important thing to decide and adopted the blues style in Task Two. In problem-solving, she amended the melodies when the music was not in sync with the visual images. She used the higher and lower pitch and dynamic contrast to treat the image musically. Overall, she found that multimedia composition allowed her to compose with technology for the first time. She would compose with it in the future because it was more convenient than the conventional method in composing with manuscript paper.

Student B: P. S. Lam

Research question 1a: In the creative process of computer-assisted composition, she wrote her 16-measure theme in A minor based on a chord progression with the instrumentation of voice, music box, piano, guitar, bass, harp, strings, vibraphone, French horn, flute, clarinet and percussion in a homophonic texture using theme and variation techniques. Her creative process was mainly composed using the MIDI keyboard. She found that the most important element of this piece was harmony. The inspiration was from a harmonic progression in popular music. She regarded the music as complete in consideration of form, cadence, and instrumentation.

Research question 1b: In the creative process of the multimedia composition, she started with the instrumentation of strings, taiko drum, pad 2 (warm), synth voice, and
Hammond organ in Version 1 and Rhodes piano, orchestral harp, pad 2 (warm) in Version 2 in homophonic texture and through-composed form.

**Research question 2:** Lam responded that using the keyboard was easier because she could make melodic improvisations from the harmonic progression instantly. She chose the instrumentation aurally and then tried it on the sound module. She typed the music into the notation software and then checked whether it was good or not. She used the staff view of the notation software and then made the amendments to the rhythms rather than quantizing the notes exactly. She found the mixing and panning function quite useful and felt that the music technology could help transform the preliminary ideas into the actual sound.

**Research question 3:** She responded that extramusical ideas could stimulate the composition and some melodies formed in her mind when she was watching the movie. She thought that the visual images could not tell the story completely, and the music could complement what the images could not. She found that the associated objects enabled her to have more viewpoints on the visual images. She associated a horrible and frightening mood in Version 1 and a sad feeling in Version 2. The software markers remarked the musical accents at some special points and the appropriate tempo should be the one that fits most of the sync points on the down beat. She agreed that the software could integrate the movie and music at the same time and the scale was an important element before she composed. In problem-solving, she composed a new section completely because it was quite difficult to revise the music partly when it was not in sync with the visual images. She would make the changes to the various musical elements, for example the dynamics, rhythm, and texture, to treat the images musically. Overall, the music technology helped her to compose and she
would compose with music technology after this project.

**Student C: P. Y. Kam**

**Research question 1a:** She began her composition with a melodic motive based on a chord progression with the instrumentation of flute, oboe, clarinet, alto saxophone, tenor saxophone, bassoon, French horn, trumpet, trombone, tuba, bass and snare drum, marimba, acoustic piano, string ensemble, triangle, handy bells, dulcimer, vibraphone, tom-tom, hi-hat, and cymbals in a homophonic texture in a rondo form. Her creative process was composed with *Finale* music notation software. For her the most important element was harmonic progression. Rhythm was the second most important because the piece was in a syncopated ragtime style and the inspiration was from the Broadway musical *Chicago*.

**Research question 1b:** She began her composition with a melodic motive based on a chord progression with different instrumentations in the two versions in homophonic texture using binary form.

**Research question 2:** Kam responded that it was easier to compose using the computer because she could listen to the actual sound. She learnt the percussion instruments in the rhythm section from the sound module since she was not familiar with them. Her creative process layered the music track by track into the sequencing software, with more familiar instruments first, for example, piano, wind section, brass section. In problem-solving, she set a slower tempo to play the notes from the keyboard into the computer, especially when she recorded the rhythm section. When she typed a wrong note, she would delete it and then type it again on the keyboard. The *solo*, *mute*, and *record* functions on the main view were quite useful to her,
especially when the music did not sound right. The solo function helped her to edit tracks individually. She suggested that the sequencing software should contain the features of the notation software, such as Finale, which has the staff view allowing composers to copy and paste and divide the score into parts.

**Research question 3:** She responded that the extramusical ideas could stimulate the composition but they also imposed some restrictions on her composition. She thought that the music could bring out the messages of the visual images more clearly than merely the images themselves. She associated the images with the modes and used the modal changes to show the contrast of the mood in the movie. She associated Version 1 with tranquility and Version 2 with more energy. She did not use many markers to assist her composition. She decided the tempo of the music intuitively by the first impressions in Version 1. In the multimedia composition, musical style was the most important because it gave her musical ideas. In problem-solving, she would amend the rhythm and the melodies when the music was not in sync with the images. She did not treat the sync points individually in Version 1 but used scale passages to treat the sync points in Version 2. She commented that the sound quality of the sound module should be improved. Overall, she thought that the project was meaningful and she learnt to use different sequencing and notation software although the recording technique was quite difficult to learn. She said that she would compose with music technology in the future.

**Student D: S. N. So**

**Research question 1a:** She began her composition using an isorhythmic technique with the instrumentation of celesta, tinkle bell, xylophone, shamisen, taiko drum 1, taiko drum 2, shaker, mute triangle, low bongo, low conga, low agogo, high wood
block in a polyphonic texture and through-composed form. She started the composition with the *Finale* notation software. For her the most important element was rhythm after she was inspired by the Gamelan music of Indonesia. She regarded the music as complete depending on the feeling and the flow of the music.

**Research question 1b:** She began her composition with Latin and African styles in Version 1 and Chinese and Japanese styles in Version 2 in a through-composed form.

**Research question 2:** So responded that composing with an acoustic piano was easier for her since there were too many set-ups for the computer. She chose the instrumentation aurally then tried them in the sound module. She typed the notes to the notation software and checked whether it was good or not and when dealing with the rhythmic section she did not use the quantization function. The mixing and panning function was useful especially when she mixed the different percussion instruments together. She commented that the tonal qualities of the instruments were too fine because the tone colours of the real instruments were a little bit raw. She commented that the number of instruments of the sound module could be increased and the quality of the sample could be improved.

**Research question 3:** She responded that extramusical ideas could stimulate composition but they also imposed some restrictions on her composition. She thought that images and music could not be separated from each other because both of them expressed the same mood at the same time. She associated a more spirited, jocular mood with Version 1 and associated calmness with Version 2. In the multimedia composition, the markers could stress some specific places while choosing the appropriate tempo. In problem-solving, she would amend the melodies when the
music was not in sync with the images. Overall, she thought that it was a new and interesting project but she did not have enough time familiarize herself with music technology.

Student E: C. L. Choi

Research question 1a: She began her composition with sequences and scalar patterns with the instrumentation of violin, viola, cello, trumpet, and harp in a polyphonic texture in ternary form. Her creative process was mainly composed using the MIDI keyboard. For her the most important element was melody. The development of the piece was the improvisations of the melodies. She planned to compose a piece in a romantic style.

Research question 1b: She began her composition in C major based on a chord progression with different sets of instrumentation in the two versions. One was in a homophonic texture and the other was in a polyphonic texture. Both versions used a theme and variation technique.

Research question 2: Choi responded that playing with the MIDI keyboard was easier for her because she could play all parts instantly. Also, the sequencing software could capture her emotion instantly. The sequencing software allowed her to record some of the instruments, such as harp that she could not play it in real life. She did not apply the quantization function because it made the music less emotional and not humanized enough. The mixing and panning function was useful since it helped her to emphasize the melodic ideas. She hoped that the best way was to compose without any technical problems in music technology.
**Research question 3:** She responded that the extramusical ideas, such as images could be stimulating to a composer. However, it also imposed the restrictions to her composition at certain level. She associated a natural, comfortable feeling in Version 1 and associated happiness with hope in Version 2. The marker helped her avoid the time lag between the visual image and the music. She deleted the melodic ideas when it was not in sync with the images and composed other melodic ideas to fit the images. She used dynamics, or ascending and descending scale passages to fit the movements of the visual images. She commented that the hardware was too expensive and it was not an easy task to learn the skills of music technology in composing. However, this project enabled her to learn things such as sequencing and composing.

**Student F: C. L. Yung**

**Research question 1:** He began the composition in E minor for orchestra containing a 16-measure theme which was played by strings. It was in a contrapuntal texture in ternary form. He started with the *Finale* notation software. He started with the melody and his inspiration was from Shostakovich’s music.

**Research question 1b:** He began his composition based on a chord progression in a polyphonic texture in Version 1 and a series of modulations in homophonic texture in Version 2. He considered the instrumentation first and wrote in a classical style in the multimedia composition.

**Research question 2:** Yung responded that using the computer was easier to compose because he could hear the actual sound instantly. He chose the instrumentation aurally in his mind then tried it on the sound module. The mixing and panning function was helpful for him to balance the sound of the virtual orchestra. He observed that the
sound of a chord played by the MIDI seemed to have less dissonance than the sound played by acoustic instruments. He commented that the instruments of the sound module could be more humanized and the composing software should contain both sequencing and notation functions.

**Research question 3:** He responded that the extramusical ideas, such as the colour of the visual images were stimulating, for example, white could represent happiness and black could represent sadness. He found that the associated objects helped him get the feeling of the movies. He would give treatments such as phrasing of the melodies to the sync points. Overall, he admitted that to set an appropriate tempo was difficult in the creative process of multimedia composition, but he would continue to compose with technology in the future.

**Student G: C. H. Tang**

**Research question 1:** He began his composition in G minor with a flattened 2\(^{nd}\) in a polyphonic texture in ABA form. He mainly composed using the MIDI keyboard. For him the most important element was melody. He further explored the spatial elements in his composition. The piece was composed in a polyphonic texture, as the tracks were layered one by one in the sequencing software.

**Research question 1b:** He began his composition with a specific motive in a polyphonic texture for both versions. The form was through-composed. He considered the most important element was melody, texture, and then harmony.

**Research question 2:** Tang responded that he preferred to compose with manuscript paper when he composed a contrapuntal texture. However, he preferred to record
directly onto the computer for a homophonic texture. He thought that the quantization function was useful during the creative process because it provided accuracy to the rhythm of a melodic contour. The mixing and panning function was effective because it made the music spacious in the final mix. He suggested increasing the number of MIDI channels in one module, so that the sound quality could be improved.

Research question 3: He responded that the extramusical ideas such as composing based on a storyboard were used in this composition. He thought that both images and music were used to express feelings. The associated objects helped him get the feel of the movies. Version 1 he associated with a darker mood, which was filled with confusion. Version 2 he associated with a peaceful mood with calmness. The name of the markers helped him pay attention to the important point of the movie. He changed the tempo until most of the sync points were on the downbeat. He deleted the whole section when the music was not in sync with the images, and then composed a new section to replace it. Overall, he commented that the multimedia project was a good way to express himself, but the teaching of different musical styles could be further discussed in the module. He would like to continue to compose with music technology in the future.

Student H: K. L. Lai

Research question 1: He began his composition in F Mixolydian scale. The main melody was played by trombone in measure 13. The instrumentation was acoustic bass, string pizzicato, trombone, and bongo with polyphonic texture in the through-composed form. He mainly composed using the Finale notation software. For him the most important element in this piece was rhythm. The inspiration was to express a timeless effect—everything goes wrong, and then all the instruments were
played in different beats. This piece was intended to imitate African drumming.

**Research question 1b:** The piece was written in E minor with a techno style in ternary form (ABA) in Version 1 and rock style in binary form (AB) in Version 2. Both were written in a homophonic texture. He associated it with a mysterious mood in Version 1 and a raw, industrial style in Version 2.

**Research question 2:** Lai responded that it was easier to compose using the computer because he could record the music instantly. He chose the instrumentation aurally in his mind, then tried it in the sound module. The quantization function was useful because it made the music more accurate. The mixing and panning was useful because it helped make the music more spacious. He wished that the computer could be set up with a sensor into his brain, so that he could compose music when he was thinking.

**Research question 3:** He responded that the moving of the objects and the change of colours or scenes could stimulate the composition. He thought that there was a close relationship between visual images and music. One could produce the images or movies after the music and the composers could compose the music after the images or movies. The association of objects was helpful in composing the music. The markers in the software helped him to figure out the structure of the music. To treat the sync points musically, he placed the entrance of the main theme so as to accent the sync point in Version 1 and he used a thick texture and changed the harmonic progression to fit the sync points in Version 2. He commented that the movie could be a stimulus but to a certain extent also imposed some restrictions.
Student I: M. F. Yeung

**Research question 1:** He began his computer-assisted composition with an Arabic scale in a homophonic texture in AABA form. He mainly composed with the *Finale* notation software in a rock style.

**Research question 1b:** He began his multimedia composition with harmonic progressions with a combo section in a homophonic texture in both versions. The mood in Version 1 was rigorous and in Version 2 a sad emotion was portrayed.

**Research question 2:** Yeung responded that he planned aurally with the instrumentation in his mind before he chose it from the sound module. The inspiration was from Arab music and he then improvised with it on the MIDI keyboard. For the instruments more familiar to him, he did not need the assistance of the computer to know the effects, or the sound of the music. For those less familiar, he would use the MIDI keyboard to experiment the sound. The quantization function was good, especially when it was applied to the rhythm section. However, he thought that the melody should not be quantized in too exact a manner. The mixing and panning function was useful. It would not be a complete work without the final mix. He found that music technology could help transform the preliminary ideas into the actual sound because it was much better than thinking about the music in one’s mind.

**Research question 3:** He responded that the visual image could stimulate composition. Both the images and music were media to express one’s feelings. The software marker was not too important but it was helpful to set the tempo of the music in the movie. He watched the movie with the metronome to see if the tempo suited the mood or not. In problem-solving, he deleted some of the sync points or changed the
phrasing to fit the sync points. He also tackled the problem with the correlation of the timing of the movie with the number of measures. The marker reminded him to pay more attention to the sync points. He commented that the sound quality of the sample could be improved. Although it was quite time consuming, the multimedia project was a practical way to learn how to compose music for visual images. He would like to compose this way in the future because he could produce the sounds of instruments that he could not play in reality.

Student J: E. S. Huynh

Research question 1: He began his composition with an introduction and then presented the theme with the instrumentation of string ensemble I & II, flute, oboe, horn, piano, vibraphone, bassoon, harp, tuba and trombone and cymbals, bell tree in both homophonic and polyphonic textures. He mainly composed using the MIDI keyboard. The priority of the importance of the musical elements was: melody, harmony, rhythm, tempo, and instrumentation. The inspiration was a portrayal of the transition of darkness to dawn.

Research question 1b: He began the piece with a chromatic descending bass pattern with a homophonic texture using a through-composed form in Version 1 and diatonic ascending bass pattern with a polyphonic texture using a through-composed form in Version 2. It was composed in a pop style in Version 1 and a baroque style in Version 2.

Research question 2: Huynh responded that he preferred using the keyboard to record onto the computer. He chose the instruments with a combination of different registers in mind. He typed the music into the computer, and listened to it. If it was
not good enough, he would amend it. The quantization function was not so useful because the effect was not humanized enough.

**Research question 3:** He responded that some musical ideas were stimulated when he saw the images. When he saw the images, some music might appear in his mind. When he listened to music, some pictures might appear in his mind. Thus, there was a close relationship between visual images and music. In problem-solving, he would treat the sync points in different ways: (1) change the tempo; (2) correct or delete and recompose the section. He commented that it was a convenient way to compose but the sound quality needed further improvement. He would compose with music technology in the future.

In the following section, the results for research question 4 are presented. To provide a structure for the discussion, detailed descriptions are provided of what was found among the 10 participants concerning developmental patterns in composition. These descriptions are focused on the commonalities of the processes and strategies exhibited in each task. Following these descriptions is a discussion about the patterns that emerged as a result of the analyses of research questions 1, 2, and 3.

Firstly, the relationship between the four data sources will be discussed. The data sources as presented in chapter 3 are:

1. written report
2. semi-structured interviews
3. self-reflective journals, and
4. MIDI file observation.
Secondly, patterns that have emerged in using music technology to compose in each task will be presented. The commonalities from each data source are analyzed as follows for the two tasks. In Task One (Computer-Assisted Composition):

1. Commonalities among the 10 participants in responding to the musical elements at the early stage of the creative process;
2. Commonalities among the 10 participants in applying music technology during the process; and
3. Commonalities among the 10 participants in reflecting on computer-assisted composition at the end of the creative process.

In Task Two (Multimedia Composition):

4. Commonalities among the 10 participants in responding to the visual images at the early stage of the creative process;
5. Commonalities among the 10 participants in applying music technology during the process;
6. Commonalities among the 10 participants in reflecting on multimedia composition at the end of the creative process.

Finally, the commonalities from these four data sources in Task One and Task Two are presented as a framework to investigate how music technology enhances the creative process within the same group of participants as related to research question 1.
7.2 RELATIONSHIPS BETWEEN THE FOUR DATA SOURCES

The relationships between the written report, semi-structured interviews, self-reflective journals, and MIDI file observation during the creative process are categorized into three stages. In Task One, these include: 1, exploration stage; 2, application stage; and 3, reflection stage, as shown in Table 7.1.
Table 7.1

*Relationships among the four data sources during the creative process in Task One*

<table>
<thead>
<tr>
<th>Written report</th>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
<th></th>
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<td>Use of musical elements:</td>
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<tr>
<td>1. Theme</td>
<td>Q5 Inspiration – initial ideas</td>
<td>Inspirations</td>
<td>Recording</td>
<td>Exploration</td>
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<tr>
<td>2. Development</td>
<td>Q6 Inspiration – initial ideas that develop</td>
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<tr>
<td>3. Harmony</td>
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<td>Playing/Listening</td>
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<tr>
<td>4. Instrumentation</td>
<td>Q3 Musical elements – ideas to explore</td>
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<td>5. Texture</td>
<td>Q4 Musical elements – instrumentation</td>
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</tr>
<tr>
<td>6. Form</td>
<td>Q12 Musical elements – texture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q14 Musical elements – Form, structure and expectation of composition</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Q8</td>
<td>Improvising/Evaluating</td>
<td>Application</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Functions of technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q13 Benefits</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q7 Transformation of ideas</td>
<td>Issues/Problems</td>
<td>Editing</td>
<td>Reflection</td>
</tr>
<tr>
<td></td>
<td>Q11 Computer-assisted composition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q15 Inspiration from visual images</td>
<td></td>
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</tr>
</tbody>
</table>
In the exploration stage, the source of students’ inspiration was based on the response to the semi-structured interview questions 5 and 6, and the self-reflective journals in relation to how the participants used theme and development in their written reports. The MIDI file recorded the theme as evidence and showed how it was developed at this stage in Figure 5.23. The composer continuously changed between two perspectives: playing/improvising and listening/evaluating the musical ideas in computer-assisted composition at this stage.

Interview questions 3, 4, 12 and 14 were closely related to how the students approached the elements of instrumentation, texture, form and harmony as stated in the written reports. The different musical elements showed as the fragments of the piece in the MIDI file. The purpose of having both musical elements—form and texture—in written reports and interviews is to affirm their reliability. In interview questions 4 and 12, students were asked about the instrumentation and texture of the composition as these were related to the choice of instruments and layering of the piece in the MIDI file.

In the application stage, interview questions 1 and 2 explored the way the students composed using music technology with the MIDI keyboard or notational software. It related to the MIDI file observation on how the students improvised on the keyboard or evaluated individual parts in the notational software. Questions 8 and 9 related to how the two important functions in music technology—quantization and mixing—and also panning enhance the creative products in the MIDI file. General issues were enquired about in the self-reflective journals in order to collect data on the students’ perceptions of using music technology to compose in relation to question 13.
In the reflection stage, interview question 7 is about the quantization function in relation to music editing in the MIDI file. At this stage, issues about the creative process and music technology were discussed in the self-reflective journals and related to the transformation from preliminary musical ideas to creative products.

The relationships between the written reports, semi-structured interviews, self-reflective journals, and MIDI file observation during the creative process were categorized into three stages. In Task Two, these include: stage 1, imagination stage; stage 2, application stage; stage 3, reflection stage, as shown in Table 7.2.
### Table 7.2

**Relationships between Four Data Sources during the Creative Process in Task Two**

<table>
<thead>
<tr>
<th>Written Report</th>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use of musical elements:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Theme</td>
<td>Q1 Inspiration – extra musical ideas</td>
<td>Inspiration</td>
<td>Visualizing</td>
</tr>
<tr>
<td>2. Development (Version A &amp; B)</td>
<td>Q4 Inspiration – process</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q2 Imagination – relationship between visual &amp; music</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q3 Imagination – association with images</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q5 Imagination – association with mood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Harmony</td>
<td>Q7 Musical elements – tempo</td>
<td>Music Technology</td>
<td>Composing</td>
</tr>
<tr>
<td>4. Instrumentation</td>
<td>Q9 Musical elements – ideas to explore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Texture</td>
<td>Q10 Musical elements – style</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Form</td>
<td>Q12 Musical elements – structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q13 Musical elements – structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Q6</strong></td>
<td>Q14 Use of technology</td>
<td>Issues/Reflection</td>
<td>Editing</td>
</tr>
<tr>
<td><strong>Q8</strong></td>
<td>Q11 Problems – applications of technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Q15</strong></td>
<td>Q15 Benefits</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The imagination stage focused on the relationship between the visual stimulus and musical accent. The source of students’ inspirations was recorded in the responses to the semi-structured interview questions 1 and 4 and the collected self-reflective
journals in relation to how the participants used the musical elements of theme and development in their written report. The interview questions 3 and 5 emphasized the imagination process, including the association with images and mood. Question 2 provided information on the alignment of visual stimulus and musical accent with synchronizing and associating process in the MIDI file observation. From Figure 5.24, the findings represented that the composer continuously changes between two perspectives: synchronizing-composing and associating-composing the musical ideas in multimedia composition at this stage.

In the application stage, interview question 7 emphasized finding the appropriate tempo in Task Two in order to put the visual images into alignment with the music by using music technology. The participants’ thinking process is also reflected in the journals. In the written reports, musical elements such as harmony, instrumentation, texture, and form were related to interview question 9 about the decision-making process. Question 10 focused on the overall musical style which was an integration of different musical elements to fit the storyboard of the movie. Questions 12 and 13 emphasized the treatment of the alignment of the structure in terms of the musical elements in the written reports. Question 8 showed how music technology integrates the movie and music in relation to the MIDI file in composing.

In the reflection stage, Questions 6 and 14 explored how the software markers and the limitations of music technology related to the participants’ reflections on their problems as encountered during the process. Question 11 refers to the problem-solving techniques used when the music is not in sync with the visual images and the editing process in the MIDI file. The MIDI file confirmed the findings. To conclude this phase of the research, Question 15 summarizes the students’ experience
in using music technology to compose in Task One and Task Two.

7.3 TASK ONE

7.3.1 Task One—Commonalities among the 10 Participants in terms of Interaction with the Musical Elements in Computer-Assisted Composition at the Beginning of the Creative Process
Table 7.3

*Task One—Commonalities among Data Sources at the Beginning of the Creative Process*

<table>
<thead>
<tr>
<th>Written report</th>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Theme: Scales or motives as the starting point</td>
<td>Q.5 Inspiration: It can be musical or extramusical</td>
<td>Two ways of stimulation: The inspiration could be from musical elements or a musical piece. It could be an improvisation on a harmonic progression. The musical piece had a close relationship with the student’s listening preferences.</td>
<td>Recording</td>
</tr>
<tr>
<td>2. Development Five aspects of musical elements: instrumentation, textures, harmony, rhythm and improvisation</td>
<td>Q.6 Intention: Task oriented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Harmony Harmony as the trigger point</td>
<td>Q.3 Musical Elements: Melody, rhythm and harmony as the first step</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Instrumentation Cross boundaries on instrumentation</td>
<td>Q.4 Instrumentation Sound in mind before choosing from the module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Texture Homophonic or polyphonic texture</td>
<td>Q.12 Texture No differences in textural writing with music technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Form Formal structure from classical musicians</td>
<td>Q.14 Completion Factors: expression of feeling, form, cadence, time restriction, tempo</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two ways of stimulation:
- The inspiration could be from musical elements or a musical piece. It could be an improvisation on a harmonic progression. The musical piece had a close relationship with the student’s listening preferences.

Playing/Listening Continuously switching between two perspectives

Exploration
In the exploration stage, it was apparent that the inspiration could be musical or extramusical in both the interviews and journal findings. In the journal findings, it was interesting to observe that the pieces had a close relationship with the students’ listening preferences. Since the research was task oriented, it would be interesting to see how the listening preferences influence their work in further discussion.

In the interview findings, it was clear that the students had specific instruments in mind before searching in the module. Also, there were no differences in textural writing when the students composed with music technology. They constantly changed between homophonic and polyphonic textures in computer-assisted composition.

In terms of musical elements, scales and motives were the starting point in writing the theme. Students develop the theme with harmony, rhythm, instrumentation, textures and improvisation. In the MIDI file observation, it was evident that the students continuously changed between two perspectives: playing, improvising on the keyboard, and listening, evaluating their own music creation from the software.

In terms of form and structure, the classical musicians tended to apply conventional structures during the work design process, for example, ABA, AB, rondo, and so on. It had to do with their classical music training background. When the classical musicians completed the piece, they tended to consider the factors such as expression of feelings, form, cadence, tempo and time restriction. Since the composition was task oriented, time restriction was an important factor to have the piece completed before the deadline of submission.
### Task One—Commonalities among the 10 Participants Applying Music Technology in Computer-Assisted Composition during the Creative Process

Table 7.4

<table>
<thead>
<tr>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.1 Notation software vs. MIDI keyboard</td>
<td>Music Technology</td>
<td>Improvising/Evaluating</td>
<td></td>
</tr>
<tr>
<td>No correlation between piano majors using MIDI keyboard and non-keyboard majors using notation software to compose</td>
<td>1. Sample of the instruments</td>
<td>Continuously</td>
<td></td>
</tr>
<tr>
<td>2. Quantize Function</td>
<td>Extend the sample into a newly generated sound or newly designed instrument</td>
<td>switching between two perspectives</td>
<td></td>
</tr>
<tr>
<td>Q.2 Preferences</td>
<td>2. Transferring file</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eight out of 10 students expressed their view that using music technology is easier for them to compose</td>
<td>Transferring files from notation software to sequencing software was an issue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.8 Quantize Function</td>
<td>3. Spatial elements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A wonderful tool for rhythm section, but not humanized enough for other parts</td>
<td>The spatial effect was an effective tool in music technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.9 Mixing and Panning Function</td>
<td>4. Quantization function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All students agreed that it was useful especially for the balancing of sounds and tracks and spatial effect with the panning functions</td>
<td>It was effective in applying to the combo section and complicated rhythms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.13 Benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrating Notation and Sequencing Software</td>
<td></td>
<td></td>
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</tbody>
</table>
In the application stage, it was apparent that there was no correlation between the keyboard majors who were using the MIDI keyboard and non-keyboard majors using notation software to compose. In the MIDI file observation, students tended to switch between improvising on the keyboard and evaluating the musical ideas through the software.

In the journal findings, the students expressed that the sampling of the instruments could be extended into a newly generated sound. Transferring files from the notation to sequencing software was an important issue. Integrating the use of notation and sequencing software was suggested in the interviews.

Quantization, along with mixing and panning were two important functions in computer-assisted composition. The quantize function was a great tool for the rhythm section particularly in using complicated rhythms as shown in both the interviews and journal findings. The mixing and panning functions created a new musical element—this was the spatial element in using music technology to compose. All students agreed that it was useful especially for the balance of sound and tracks with spatial effects through the panning functions in both the interviews and journals.

Finally, according to their preferences, eight out of ten students expressed in their interviews that using music technology made it easier for them to compose.
7.3.3 Task One—Commonalities among the 10 Participants Reflecting on Computer-Assisted Composition at the End of the Creative Process

Table 7.5

<table>
<thead>
<tr>
<th>Interviews</th>
<th>Journal</th>
<th>MIDI file</th>
<th>Reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q7 Transformation of ideas</td>
<td>Issues/Problems</td>
<td>Editing</td>
<td>Reflection</td>
</tr>
<tr>
<td>1. Recording, listening, checking, and editing were the prominent issues</td>
<td>1. Problem-Solving Techniques: Develop musical thinking through organizing musical elements in the task</td>
<td>The composer continuously worked out the creation of shifting around these two categories: Formalized and precise vs. Contextualized and humanized</td>
<td></td>
</tr>
<tr>
<td>2. It is fairly convenient for them in layering the music track by track, section by section</td>
<td>2. Compositional Techniques: Provide solutions to link up or connect musical ideas between sections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q11 Computer-assisted composition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All students agreed that music technology could transform the music in mind into actual sound</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Q15 Inspiration from visual images</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extramusical ideas can act as stimuli to students in the creative process, particularly linked to the visual images in Task Two</td>
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<td></td>
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</tr>
</tbody>
</table>

In the reflection stage, students discussed problem-solving and compositional techniques in their journals. They developed musical thinking through organizing musical elements in the task and then they provided solutions to link up or connect
musical ideas between sections because most of the students encounter the issues of separation of musical ideas. In the interviews, question 7 stated that the music technology could transform musical ideas into creative products because it is fairly convenient for them to layer the music track by track, and section by section to solve the problem was identified in the journals.

In the interviews, recording, listening, checking, and editing were the prominent issues identified in the transformation of ideas. It affirms the findings of the MIDI file observation in which the composers continuously worked out the music creation by shifting around the two kinds of composing practices: formalized and precise, and contextualized and humanized.

In computer-assisted composition, all students agreed that the music technology could transform the music in the mind into actual sound. This transformation allows the students to work with sound without the limitation of performance skills. It further affirms the findings on how music technology overcomes student’s performance skills during the creative process.

The extramusical ideas were mentioned in question 1 in the inspiration stage. It reappeared in question 15 that the extramusical ideas can act as a stimulus to students in the creative process, particularly visual images emphasized in Task Two.
7.4 TASK TWO

7.4.1 Task Two—Commonalities among the 10 Participants Responding to Visual Images in Multimedia Composition at the Beginning of the Creative Process
Table 7.6

Task Two—Commonalities among Data Sources at the Beginning of the Creative Process

<table>
<thead>
<tr>
<th>Written Report (Version A &amp; B)</th>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
</tr>
</thead>
</table>
| 1. Theme Key center and melody | **Q1 Inspiration** – extra musical ideas  
All students agreed that extramusical ideas could stimulate composition.  
**Q4 Inspiration** – process  
Build up storyboard and intuition | **Inspiration**  
The inspiration for both versions were either similar or in contrast in some ways. The rationale for asking the students to compose two versions with the same movie was to train their divergent thinking skills in creative thinking. | **Visualizing**  
**Imagination**  
Synchronizing / Associating  
Continuously switching between two perspectives |
|  | **Q2 Imagination** –relationship between visual & music  
All students agreed that visual images and musical ideas are closely related.  
**Q3 Imagination** – association with images  
Seven students found that the associated objects can actually enhance the association in music. Two of them even expanded into an associated mood or images with modes.  
**Q5 Imagination** – association with mood  
Music students preferred to use their imagination and intuitive thoughts to approach Task two rather than accumulating a chain of sync points. | | |

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In the imagination stage, all the students agreed that extramusical ideas can stimulate composition, and the relationship between visual images and musical ideas are closely related. During the inspiration process, it was evident that the students preferred to use their imagination and intuitive thoughts to approach the visual image rather than calculating a chain of sync points. The markers view in the software was particularly helpful in order to view a chain of sync points. However, it was found that the students associated the sync points with their imagination and intuition. Since the software could easily align the movie and music, students could concentrate on the writing and thinking processes.

There were seven students who found that the associated objects can actually enhance the association in music in building the storyboard and their intuition. This allows the students to improve their judgment in aligning or not aligning between the visual images and musical accents. It affirms the findings from the MIDI file observation that the students continuously changed between two perspectives: synchronizing and associating.

In terms of musical elements, students wrote their initial theme at this stage when visualizing the task in the MIDI file. The key center and theme were identified as the most important elements associated with the movie at this stage of the compositional process.

7.4.2 Task Two—Commonalities among the 10 Participants Applying Music Technology in Multimedia Composition during the Creative Process
Table 7.7

*Task Two—Commonalities among Data Sources during the Creative Process*

<table>
<thead>
<tr>
<th>Written Report</th>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Harmony</td>
<td>Q7 Musical elements – tempo</td>
<td>Music Technology: Students provided a couple of solutions to the problems of the lack of continuity between sections in multimedia composition</td>
<td>Composing composers work with different musical styles in order to align the visual stimulus and musical accent</td>
<td></td>
</tr>
<tr>
<td>Students used the same harmonic progression in both versions but modified with different styles</td>
<td>All students found that setting the appropriate tempo in order to fit most of the sync points in the down beat or strong beat was useful</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Instrumentation</td>
<td>Q9 Musical elements – expectation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eight out of 10 students used entirely different combinations of instruments in version 1 and version 2</td>
<td>Musical Styles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Texture</td>
<td>Q10 Musical elements – style</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approaching different visual images can trigger students’ creativity in using different textures to fit the musical style or <em>sync points</em></td>
<td>Approach different styles in version 1 and version 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Form</td>
<td>Q12 Treatment of the visual stimulus as musical accent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change of scenery in the movie could strongly affect the students’ perception in organizing musical sound</td>
<td>1. change of meter, pitch, harmony, dynamics, texture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. use of ascending/descending scale and arpeggio passage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. use of musical phrase, and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. use of percussion instruments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q13 Musical elements – structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All students agreed that the use of musical accent can emphasize the sync point in the movie</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
In the application stage, students worked with different musical styles in order to align the visual stimulus and the musical accent. This was observed in the MIDI file. Musical styles became the most important issue in the decision-making process. According to the interview scripts, students decided the appropriate tempo in order to fit most of the sync points on the downbeat or strong beat.

In order to work with different musical styles in multimedia composition, students created a similar harmonic progression in both versions. Different instrumentations were used in both versions. Eight out of 10 students used entirely different combinations of instruments in Version 1 and Version 2. Different textures were used in both versions to fit the musical style or sync points.

In terms of form, the change of scenery in the movie could strongly affect the students’ perception in organizing musical sound. The structure of the movie would strongly affect the structure of the music rather than designing the musical form in a through-composed way in Task One.

The treatment of visual stimulus as a musical accent was shown in the MIDI file observation and interview scripts. It could be summarized as follows:

1. change of meter, pitch, harmony, dynamics, and texture
2. use of ascending, descending scale and arpeggio passages
3. use of musical phrases, and
4. use of percussion instruments.

Finally, all students agreed that the use of musical accents could emphasize the sync point in movies.
7.4.3 Task Two—Commonalities among the 10 Participants Reflecting on Multimedia Composition at the End of the Creative Process

Table 7.8

Task Two—Commonalities among Data Sources at the end of the Creative Process

<table>
<thead>
<tr>
<th>Interview</th>
<th>Journal</th>
<th>MIDI file</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q6 Software Markers</td>
<td>Issues/ Problems</td>
<td>Editing</td>
</tr>
<tr>
<td>Nine out of 10 students thought that the software markers were helpful especially in figuring out the tempo and structure of the piece</td>
<td>Most of the students used the tempo to shift the time frame to fit the downbeat of the music as a musical accent</td>
<td>The composer continuously worked out the creation of shifting around these two categories: Aligned and structured vs. Contextualized and intuitive</td>
</tr>
<tr>
<td>Q14 Limitations and suggestions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Improving the sound quality of the samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Increasing the numbers of instruments and patch lists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Integrating the notation and sequencing software, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Lowering the price of software and hardware</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8 Integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All students agree that the software Sonar 3 can integrate the audio, MIDI and video</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q11 Problem-solving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. making amendments of rhythm, melody, instrumentation, texture, form etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. changing the tempo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. correcting or deleting and recomposing the section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15 Benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of the students indicated that they will keep on composing with technology in the future</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In the reflection stage, students continuously worked out the creation of shifting around these two kinds of composing practice: (1) aligned and structured; (2) contextualized and intuitive.

In the first category from the journal findings, students used the tempo to shift the time frame to fit the downbeat of the music as a musical accent. In the interviews, they used the software markers specifically to figure out the tempo and structure of the piece.

In the second category, students were concerned with the musical style and mood in the multimedia composition. The students decided on the style with their intuitive thoughts and they edited the length in each section and connected different musical ideas to fit the music into context. As a problem-solving technique, students shifted these two categories around and ended up with the following solutions during the self-reflective stage in the creative process:

1. making amendments of rhythms, melodies, instrumentation, texture, forms, and so on
2. changing the tempo
3. correcting or deleting and recomposing section.

In the interviews, students gave some positive comments and suggestions on the use of music technology in computer-assisted and multimedia composition as follows:

1. Improving the sound quality of the samples
2. Increasing the numbers of instruments and patch lists
3. Integrating the notation and sequencing software, and
4. Lowering the price of software and hardware.
To conclude, students’ expectations demanded more than the present development of music technology offered, especially as far as advances in music software and hardware were concerned. The integration of sequencing software and software synthesizers was proposed. The notation of the sequencing software should be enhanced to meet the needs of the students in editing parts and scores. In fact, the increasing popularity of the music software and hardware had made them more affordable to the students in the past five years.

7.5 RESPONDING TO RESEARCH QUESTION 4 - PROPOSED MODEL FROM THE DEVELOPMENTAL PERSPECTIVES IN COMPUTER-ASSISTED COMPOSITION AND MULTIMEDIA COMPOSITION

In the following section, three stages of the creative process were suggested in computer-assisted composition: (1) listening and recording; (2) improvising and evaluating; and (3) recording, editing, problem-solving, and revising. The flowchart in Figure 7.1 illustrates how musical knowledge is built up through computer-assisted composition. After observing and participating in the composition of music, students offered further insights into structures and processes in using music technology to compose.
7.5.1 Spiral Development in the Creative Process of Computer-Assisted Composition

![Spiral Development Diagram]

**Figure 7.1** Spiral Development in the Creative Process of Computer-assisted Composition.
In the exploration stage, the students recorded their musical ideas into the software by shifting two kinds of composing practices—playing and/or listening with different musical elements: Theme (melody and rhythm), Harmony, Form, Instrumentation and Texture. In this stage, different musical ideas were recorded through music notation or MIDI keyboard. From the findings of the written report, scales and motives were decided while writing the theme. In terms of harmony, an initial harmonic progression was mostly considered. In terms of instrumentation, different instruments could be selected through sound modules or samplers. It was not limited by cultures or availability of the instruments. In terms of form, consistency was important because formal structure was adopted in classical music. In terms of texture, any kind of layering was possible in computer-assisted composition.

In the application stage, student elaborated their musical ideas in the sequencing software by shifting two kinds of composing practice—improvising and/or evaluating with music technology. Students could improvise on the MIDI keyboard while they were composing and evaluating the composition through the notation software.

In the reflection stage, students revised their composition through listening to the sample of the instruments. During the decision-making process, the students continuously worked out the creation by shifting around these two kinds of composing practice: formalized and precise, contextualized and humanized. Students decided how the notes were played by the sequencing software, for example, the articulation, phrasing, dynamic, duration. In the problem-solving process, students developed musical thinking through organizing musical elements in the task and provided solutions to link up musical ideas. Students kept on refining their musical
ideas at this stage.

7.5.2 Spiral Development in the Creative Process of Multimedia Composition

In the following section, three stages of the creative process are suggested in the multimedia composition: (1) visualizing, synchronizing, and associating; (2) composing and integrating; and (3) editing, problem-solving, and revising. The flowchart in Figure 7.2 illustrates how creative thinking in multimedia composition is developed. After observing the multimedia composition of music students, further insights into structures and processes in using music technology to integrate the visual images and music were gained.
Figure 7.2 Spiral Development in the Creative Process of Multimedia Composition.
In the imagination stage, student recorded their musical ideas using the sequencing software. They switched between two kinds of composing practice—synchronizing and/or associating the visual images with different musical elements: theme (melody and rhythm), harmony, form, instrumentation and texture. In this stage, visual images were described and typed into the sequencing software by inserting markers on the sequencing software. From the findings of the written report it was apparent that the key center and motives were decided while writing the theme.

In the application stage, students elaborated their musical ideas in the sequencing software by switching between two kinds of composing practice—composing and/or aligning with music technology. Students could decide on the treatment of the visual stimulus while they were composing and aligning the composition using the sequencing software. An overall musical style was chosen and an appropriate tempo was selected during this stage.

In the reflection stage, students revised their compositions through listening to the sample of the instruments and watching the movie on the computer screen. During the decision-making process, the students continuously worked out their creation by shifting these two categories around: aligned and structure, contextualized and intuitive. In the problem-solving process, students developed divergent thinking during the task by composing different versions of music for the same movie. Convergent thinking and divergent thinking were particularly emphasized in Webster's creative thinking model. After all, composing with visual images was an open-ended task. The solutions to the problem could be infinite because the treatment of the visual image in music was unknown until the student came up with the creative product at the end.
7.5.3 The Extension of Webster’s Model of Creative Thinking to Computer-Assisted and Multimedia Composition

In this section, Webster’s model (2003) of creative thinking is extended. The rationale was to investigate and observe how the spiral development of computer-assisted composition and multimedia composition could be further developed into models of the developmental patterns in computer-assisted composition and multimedia composition. The relationships between the creative processes of computer-assisted composition and multimedia composition, and creative thinking in music are discussed. Terms such as convergent thinking, divergent thinking, product intention, creative products, exploration, revising, editing, enabling skills, and enabling conditions are emphasized in the discussion. Webster’s model (2003) is designed to be representative of creative thinking by both children and adults, although certain aspects of the model might be qualitatively different at various stages of development. The stages include:

1. Product intentions: composition performance, improvisation and analysis (written and listening) can be considered at the outset of creative thinking as goals or intentions of the creator.

2. Thinking Process. This includes: (a) Enabling skills: A set of skills that allow for the thinking process to occur. One is convergent thinking skills and the other is divergent thinking skills. Convergent thinking skills are the ability to recognize rhythmic and tonal patterns and musical syntax. Divergent, imaginative skills are critical such as musical extensiveness, flexibility, originality. (b) Enabling conditions: A number of variables involved that is not musical in the creative
thinking process. Motivation could help keep the creator on task. Personality describes factors such as risk taking, spontaneity, openness, perspicacity, sense of humor and preferences for complexity. Environment defines the creator’s working conditions such as financial support, family conditions, musical instruments, acoustics, media, societal expectations and peer pressure, and so on (Webster, 2003, p. 21)

3. Creative product: composition, performance, written analysis, recorded improvisations, mental representations of the music heard. These were treated more fully in chapter 3 literature review in Fig. 3.5.

The significance of the model is that it indicates movement between divergent and convergent thinking. These stages involve time to play with ideas (preparation), time to spend away from the tasks (incubation), and time to work in structured ways through the ideas (verification) after solutions have presented themselves (illumination). The most important implication for music teaching is to allow enough time for creative thinking to occur.

The preparation stage in Webster’s model matched the findings of the present research concerning exploring musical elements and ideas in the exploration stage in the developmental pattern of computer-assisted composition and multimedia composition.

The incubation stage in Webster’s model relates to the findings of the present research concerning the creative process of improvising and evaluating in the application of music technology at this stage. Time that allowed students to think, away from the
task, is important in both tasks. This is why students were to keep on composing using their own laptop or PC at home or in the school to work out the solution.

The *working through* stage matched the findings of the present research concerning using the software for editing in a humanized way or quantized way as a decision-making process in computer-assisted composition and for editing in an aligned or intuitive way as a decision-making process in multimedia composition.

The final stage is *verification*, polishing or revising the composition into the creative product.

There are a number of connections between the creative process and the enabling skills and conditions. In computer-assisted composition, the findings of the written reports reveal that different musical elements are important in designing the piece. It connects with the enabling skills suggested by Webster in craftsmanship and aesthetic sensitivity. The student has to work with the different musical elements “inside out” in dealing with the composition tasks. In enabling conditions, the setting of the task is essential. It was important to keep the task simple and give room for the student to create some original music. The findings of MIDI file observation reveal that musical style is a crucial factor in the application stage in computer-assisted and multimedia composition. The relationship between the setting of the task and the social and cultural context of the student can affect the musical style of the composition, especially with the visual stimulus in multimedia composition. Even though the students use the same notation or sequencing software, the diversity of musical style can be generated in the application stage, even with the same movie.
In computer-assisted and multimedia composition, both convergent and divergent thinking are required. Tonic, rhythmic imagery and musical syntax are mostly connected with convergent thinking. The students have to acquire a certain amount of musical skill to express their musical languages in composition, skill in areas such as knowledge of tonal center, rhythm and musical syntax. Craftsmanship and aesthetic sensitivity are also connected with convergent thinking because they require careful manipulation of musical material in sequential ways. It closely relates to the use of musical elements in the exploration stage. Aptitudes for extensiveness, flexibility and originality are clearly connected to divergent thinking. It closely relates to the manipulation of musical style in the application stage and editing/revising in the reflection stage. This is supported by the written reports and interviews with the participants shown in Figure 7.2.

7.5.4 Developmental Patterns during the Creative Process in Computer-Assisted Composition

Following the extension of Webster’s model, the consideration of musical elements was further refined in the exploration stage. The arrows indicate the flow of the creative process. The reflection stage included the processes of editing and revising into the creative product.
Figure 7.3 Developmental patterns during the creative process in computer-assisted composition.
In the exploration stage, students developed their theme with harmony, rhythm, instrumentation, textures and improvisation. In the MIDI file observation, the students continuously switched between two perspectives: playing and improvising on the keyboard on the one hand, and listening and evaluating from the software on the other. While using the music technology to compose, students constantly switched between two perspectives: improvising on the one hand and composing on the other. Once the musical ideas were decided within the parameters of these musical elements, the draft of the composition would be recorded in the MIDI sequencing software. The benefits of the computers were that the student could save their MIDI file as real sound rather than notation. It would particularly enhance the creative process at the first stage for a musician to be a composer. Musicians would think of creating sound more than creating notation, which is supported by Paynter’s (2001) statement: “It is important to comment on what we hear rather than on what we see notated” (p. 8).

In the application stage, students refined their musical ideas from the exploration stage. By using the computer, students could further work on the details of the composition. Quantization, mixing and panning were important functions in the computer-assisted composition. The quantize function was a great tool for the rhythm section and complicated rhythms. The mixing and panning functions created a new musical-spatial element in using music technology to compose. It was useful especially for the balance of sound and tracks and spatial effect with the panning functions. In this stage, students gained the musical experience of listening and responding to the overall sound of the musical style in the composition. Once again, the complexities of the composition were not limited by the students’ level of competence in performance.
In the reflection stage, students developed problem-solving and compositional techniques. They developed musical thinking through organizing musical elements in the task and providing solutions to link or connect musical ideas between sections because most of the students encountered the issues of separation of musical ideas. Music technology can transform musical ideas into a creative product because it is fairly convenient for them in layering the music track by track, section by section to solve the problems.

The students continuously worked at the creation by shifting the results of these two kinds of composing practice around: formalized and precise, contextualized and humanized, as indicated in Figure 7.1. The decision-making process required an aural perception of sound. The student decided whether the musical phrase should be played in an exact way or in a humanized way. They could change the instrument instantly on the computer to speed up the process of inviting players to perform. This enhanced the accuracy and realism of the creative product/music composition. The score could be printed for the players to perform as a real performance of the original composition of the student.

7.5.5 Developmental Patterns during the Creative Process in Multimedia Composition

Following the extension of Webster’s model, considerations of musical elements are further refined in the imagination stage. The arrows indicate the flow of the creative process. The reflection stage includes the process of editing and revising into the creative product.
Figure 7.4 Developmental patterns during the creative process in multimedia composition.
In the imagination stage, all students agreed during the interview that extramusical ideas could stimulate the composition and that visual images and musical ideas are closely related. During the inspiration process, students preferred to use their imagination and intuitive thoughts to approach the visual image rather than calculating a chain of sync points. Since the software could easily align the movie and music, students could concentrate on the creative and musical thinking process. Students developed the theme with harmony, rhythm, instrumentation, textures, and improvisation. In the MIDI file observation, the students continuously switched between two perspectives: synchronizing and associating. The decision-making process consisted of the students choosing an overall mood indicated by the scenery or mapping musical accents in the structure.

In the application stage, students worked with different musical styles in order to align the visual stimulus and musical accent in the MIDI file observation. Musical styles became the most important issue in the decision-making process. Students decided on the appropriate tempo in order to fit most of the sync points into down beats or strong beats in synchronizing. Furthermore, the change of scenery in the movie could strongly affect the students’ perception in organizing musical sound in associated images. In terms of form, the structure of the movie strongly affected the structure of the music.

The treatment of visual stimulus as a musical accent are summarized as follows:

1. change of meter, pitch, harmony, dynamics, or texture
2. use of ascending or descending scales and arpeggio passages
3. use of musical phrases
4. use of percussion instruments.

The use of different musical elements interacted closely with the moving visual images. Film score composers look for ways to treat the image musically to set the physical, psychological and technical functions of the score. In this stage, the alignment between visual stimulus and musical accent was considered.

In the reflection stage, students continuously worked out the creation of shifting around four kinds of composing practice: aligned, structured, contextualized and intuitive. In the aligned and structured category, students used the tempo to shift the time frame to fit the downbeat of the music as a musical accent, and used the software markers especially to figure out the tempo and structure of the piece. In the contextualized and intuitive category, students were concerned with musical style and mood in multimedia composition. Students decided on the style with their intuitive thoughts and they edited the length in each section and connected different musical ideas to fit the music into context. As a problem-solving technique, students shifted around these two categories and ended up with these solutions during the revising section in the creative process:

1. making amendments of rhythm, melody, instrumentation, texture, form, and so on.
2. changing the tempo.
3. correcting or deleting and recomposing the section.

Students amended, corrected, deleted or recomposed the sections or musical phrases in this reflection stage. After problem-solving and revising, students finally had the creative product/music composition.
7.6 DISCUSSION

The findings revealed throughout this study provide a starting point for discussion on various topics. At this point, I mention the generalization of students’ composing practice in two phases: Task One—Computer-Assisted Composition and Task Two—Multimedia Composition. However, the developmental patterns that emerged from each of the tasks had strong relationships with the literature in chapter 3. The discussion will focus on what was found within the confines of this study.

7.6.1 Developmental Perspectives

In the present study, there were a series of similar findings on how the musical material was treated. What was revealed both agreed and disagreed with the work of the researchers identified in chapter 3 that dealt with developmental trends. One consistency across the students in varying degrees was the presence of melodic motives. This finding concurs with that of Kratus (1985) who also found motivic material being incorporated into students’ compositions.

In the spiral model of Swanwick (1988), the first transformation of students’ compositions involved the attraction to, and then mastery of, sound sources as entities in themselves, while the second alluded to the students’ perception, and production of the expressiveness moved from a personal to a stylized form of expression. The third involved the student creating and responding to relationships with and among the elements. The students in the present study represented the different transformations of musical elements involved in the exploration stage, for example, pitch, rhythm, harmony, timbre and form. The students displayed a variety of abilities while composing although none had previous experience with composing. This suggested that students might have different entry levels when beginning to compose.
7.6.2 Music Technology, Musical Thinking, and Decision-Making

The different stages that emerged from the review of literature about the applications of music technology by Collins (1992) were related to some of the findings in the present study. He mainly emphasized the process of composition in creativity and pointed out four elements—initiating, acquainting, controlling and structure—which constituted the basis of art activities, so that the aim of music educators was to enable students to have opportunities to engage with these elements.

Collins (1992) pointed out that the hardware could allow the user to have the opportunity to play with different melodies, chords, and timbres in the initiating and acquainting process, with the built-in possibility of discoveries being made through chance accidents. The three stages that emerged from the present study were: exploration, application, and reflection. The exploration stage concurred with the initiating stage referred to by Collins. The application stage concurred with the acquainting and controlling stage. Two more findings were made during the creative process. One was improvising with the MIDI keyboard and the second was evaluating with music notation. This further confirmed that the object-orientated music composition software, which would allow the user to deal with building blocks of sound parameters, was not necessarily in a linear sequence, and would enable the user to move positively from the initiating stage to the structuring stage in a natural progression. Additionally, it was noted that the teaching sequence should follow the acquaintance of music technology in the application of hardware and software.

Findings also concurred with additional conclusions from Moore (1989) in developing musical thinking through music technology. Experimentation and discovery learning
was suggested, and music technology could truly manipulate the various musical elements into an expressive whole. Students in the present study considered that the manipulation of musical elements was largely involved in the exploration and imagination stage in both tasks.

Additionally, it was noted that those students who expressed greater ease in finding and solving problems, and interacting with the keyboard, reflected decision-making processes of greater diversity than those who appeared to have less ability in these areas in both the application and reflection stages. It further confirmed the findings from Bamberger (1977) and Davidson and Welsh (1988) including the relationship between the students’ abilities and the kinds of decision-making processes which occurred.

7.6.3 Creativity, Creative Process and Product

The findings from the present research reflected the patterns found in the research of Davidson and Welsh (1988) and Younker and Smith (1996) depicting approaches from novice (year two music students) to expert (professional composers). Since these researchers sought the approaches of both novices and experts, they employed subjects representing those entities and outlined composing processes or stages which students experienced while composing. These stages were dynamic and recursive, and included exploring, decision-making, practicing, and performing. Not only were these processes observed in the present study, but it was also apparent that those students who manifested expert behaviours were involved in more of the processes than those who manifested novice behaviours.

The findings from the developmental patterns in both tasks related to the work of
Wallas (1926), Webster (2003), Hickey (1995), and Amabile (1996). According to Wallas, four different stages, namely, preparation (convergent thinking), incubation (musical technique), illumination (problem-solving), and verification (conclusion) are involved in the creative process. All four stages were consistent with the findings in both of the tasks and product intention with or without visual images (convergent thinking), working with musical elements (musical techniques), problem-solving in the reflection stage and revising before the creative product.

The findings were indirectly related to the work of Hickey and Amabile who compared the degree to which the students experienced the stages with the quality of their products, for example, task motivation, domain-relevant skills, creativity-relevant processes. Hickey (1995) adopted the model of Amabile in creativity with five stages: (1) task identification (compose music), (2) preparation (explore on synthesizer and practice ideas), (3) response generation (generate possible ideas, search memory), (4) response validation (test response, seek feedback), and (5) outcome (save, throw out, or revise composition).

The consideration of exploration and reflection in the developmental pattern in this research was concurred with several empirical studies had focused on compositional process. The work by Kratus (1985) on the use of time by children reliably demonstrated the presence of exploration and development. In more qualitatively based studies, Younker and Smith (1996) showed how inexperienced and more experienced composers worked with musical ideas by using revision and extension techniques naturally. Folkestad (1996) reported similar behaviours in his participants when working with music technology.
7.6.4 Computer-Assisted Composition

Several trends that emerged from the review of literature were related to some of the findings of the study. The first was that the benefits of software-based composing concurred with the studies of Leong (1995), Stevens (1996), Folkestad (1996), Reese (2001), Purse (2003), Kersten (2004). Reese (2001) considered that the compositional process enabled students to synthesize earlier learning about musical elements, presented them with interesting problems to solve, and helped them to think in sound (p. 44) and feel the expressiveness of their own creative work. From the findings of the written report and interview scripts, most of the students had the sound in mind before they started to compose. During the creative process of both tasks, it was noted that music technology could provide direct manipulation of sounds and immediate feedback to the young composer about musical decisions.

7.6.5 Multimedia Composition

From the perspective of a music theorist, Cook (1998) puts a strong emphasis on the interaction of different media in the term multimedia and explained the deeper meaning in multimedia as a whole. He used the words emotion and meaning, suggesting that sounds, pictures, and words may be aligned with one another on the grounds of shared emotional properties, and conversely that meaning emerges from such alignments.

On multimedia composition, the findings were that the students’ composition continuously changed between two perspectives: synchronizing and associating. The decision-making process was that the student could choose an overall mood of the scenery or mapping of musical accents in structure. It related to Cook’s model of the interaction of different media in the framework and laid the foundation for the testing
of similarities and differences. Some of the students’ multimedia composition contradicted or confronted the visual image and music (difference test) and some compositions complemented and contextualized the visual image and music (similarity test).

7.6.6 Alignment in Visual Stimulus and Musical Accent

From the perspective of music cognition and psychology, the Lipscomb and Kendall (1995) model suggested that there were two implicit judgments made during the perceptual processing of the movie experience: an association and a mapping of accent structures. In the developmental pattern of creative process in multimedia composition, the students continuously worked out the creation of shifting between these two categories: aligned and structured, and contextualized and intuitive. In the first category, students used the tempo to shift the time frame to fit the downbeat of the music as a musical accent and used the software markers especially to figure out the tempo and structure of the piece. In the second category, students were concerned with musical styles and moods in the multimedia composition. Students decided on the style with their intuitive thoughts and they edited the length of each section and connected different musical ideas to fit the music into a context.

The model suggested by Lipscomb and Kendall was further developed into the application with music technology in this research. The two implicit judgments laid the foundation for the development of teaching and learning in digital film scoring. It also led to the problem-solving skill suggested by Post (1999). The process for digitally scoring music to film requires skills in critical thinking, musical composition, mathematics, and computers. Digital film scoring offers students a chance to fine tune their skills in the areas mentioned in order to develop their abilities in
problem-solving in creativity.

7.6.7 Composing Strategies

The findings in the exploration and imagination stages from the developmental patterns from both tasks concur with composing strategies from Paynter (2000) and Hogg (1993) including how students responded imaginatively to a stimulus. The students were not concerned with issues such as structure and form so much, but they discovered and they enjoyed playing, and making patterns. It was a matter of feeling and emotion. Paynter (2000) concluded that

the surest way to help students to get better at composing is to encourage them to think about the essentially musical process, not as abstract rules, but directly in relation to what they themselves create. Composing is different. From the start, students must try to judge the success of what they make. Their composing decisions are vitally important. (pp. 7-8)

Therefore, decision-making in the creative process was highlighted in the framework at the reflection stage for both tasks.

Hogg’s (1993) 16 composing strategies shared some of the pedagogical approaches of this research in the teaching and learning of computer-assisted and multimedia composition, such as “keep the task simple,” “provide ongoing opportunities for students to compose,” “learn to ask questions rather than provide solutions,” “allow sufficient time for students to bring their own ideas,” and “let each new task emerge from the previous one” (p. 10). The two phases were designed to let students compose from a simple task to a more complex one. Students were asked to have lectures every
other week in order to ensure that they had sufficient time to think and to cope with the compositional problems. These kinds of strategies were useful when instructors designed the task as a project or assessment at both tertiary level and secondary level.

Burnard (1995) studied the design of a composition task and the success that students experienced when composing. In this research two types of composition task were utilized in order to provide a series of different levels of constraints and freedom. Task one was an open-ended task in which students could compose without any limitations in genre, style, instrumentation or structure. Task two was a prescription task where students could compose a soundtrack for the computer animation. The findings from the self-reflective journals and individual interviews revealed that the prescriptive task could provide a visual stimulus to the musical style. However, the visual might also create limitations to some extent in the task. The results suggested a relationship between the students’ background, commitment to the task and the amount of freedom in setting up the task in using music technology to compose.

Findings in the computer-assisted composition were that the students would improvise using MIDI keyboard and edit their work through music notation in the application stage. Burnard (1995) wrote of “improvisation in which no revisions were allowed” (p. 162). In the reflection stage, the students revised their own musical ideas into creative products as a composition. The relationship between improvisation and composition was clearly defined in chapter 3 and clearly separated during the creative process in the research studies.

Findings in the application stage from the developmental patterns from both tasks concurred with the compositional development in professional composers from
Bennett (1976) included how students expected to compose in a musical style that is familiar. Bennett suggested that the fostering of experience in music composition carries important education considerations. Developing germinal and internal musical ideas relies heavily on long-term memory and past experience. Thus students cannot be expected to compose in a style or medium which is unfamiliar. Musical styles were involved heavily in the application stage when the students improvised on the MIDI keyboard in the computer-assisted composition and when the students used different musical elements to treat the visual stimulus in the multimedia composition. The teaching of a musical style was vital in the creative process of student composers and professional composers suggested by Bennett (1976). The implication in the music education aspects was to provide some previous musical examples in a specific style for music analysis, performance and historical understanding. The entire process suggested that students must be made conscious of the various aspects and operations inherent in producing a creative product. Students would need guidance and practice in monitoring their own creative musical behaviour. This means that students must have the opportunity to listen to their compositions in both draft and final forms through live performance or music technology. Composition as a thinking process provided learners with a means to apply a wide variety of cognitive operations toward musical conceptual and skill areas.
7.7 COMPARATIVE ANALYSIS BETWEEN TASK ONE—COMPUTER-ASSISTED COMPOSITION AND TASK TWO—MULTIMEDIA COMPOSITION

As a conclusion to this chapter, the similarities and differences between the ways the students learnt the ideas and concepts in using music technology to compose in both tasks is discussed. The discussion is in three stages: (1) exploration/imagination stage, (2) application stage, and (3) reflection stage.
### Table 7.9

**Comparative Analysis of the Creative Process in Computer-Assisted Composition and Multimedia Composition**

<table>
<thead>
<tr>
<th>Task One—Computer-assisted composition (without visual images)</th>
<th>Task Two—Multimedia composition (with visual images)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Differences:</strong></td>
<td><strong>Differences:</strong></td>
</tr>
<tr>
<td>- open-ended task</td>
<td>- prescriptive task</td>
</tr>
<tr>
<td>- first phase of the research</td>
<td>- second phase of the research</td>
</tr>
<tr>
<td>- start with recording, playing, listening</td>
<td>- start with visualizing, synchronizing, associating</td>
</tr>
<tr>
<td>- apply music technology in improvising with MIDI keyboard and evaluating through notation</td>
<td>- apply music technology in integrating the visual image and music</td>
</tr>
<tr>
<td>- apply quantization function, mixing and panning function to refine the musical ideas</td>
<td>- apply synchronization function, insert marker with appropriate tempo to design the structure of the piece</td>
</tr>
<tr>
<td>- edit the musical ideas between contextualized and humanized versus formalized and precise</td>
<td>- edit the musical ideas between aligned and structure versus contextualized and intuitive</td>
</tr>
<tr>
<td><strong>Similarities:</strong></td>
<td><strong>Similarities:</strong></td>
</tr>
<tr>
<td>- deal with musical elements in the exploration stage</td>
<td>- deal with musical elements in the imagination stage</td>
</tr>
<tr>
<td>- apply music technology to compose with a specific musical style</td>
<td>- apply music technology to compose with a specific musical style</td>
</tr>
<tr>
<td>- apply decision-making in the editing process</td>
<td>- apply decision-making in the editing process</td>
</tr>
<tr>
<td>- problem-solving in connecting musical ideas between sections (musical experience with musical thinking)</td>
<td>- problem-solving in aligning between visual image and music (creative experience with convergent and divergent thinking)</td>
</tr>
<tr>
<td>- revise the work into creative product</td>
<td>- revise the work into creative product</td>
</tr>
</tbody>
</table>

The differences in how the student approached the two tasks during the creative process are shown in Table 7.1. During the exploration/imagination stage, in Task One, it was an open-ended task which allowed students to become familiar with the
software and hardware in MIDI sequencing. Task Two was a prescriptive task to compose music for a computer-animated movie. In the first phase of the research, students started by recording, playing, and listening to musical elements. In the second phase of the research, students started by visualizing, associating, and synchronizing the visual images with musical elements.

In the application stage of Task One, students applied music technology in improvising with the MIDI keyboard and evaluated with music notation. In Task Two, students applied music technology in integrating the visual images and music. In Task One, students applied the quantization function, along with the mixing and panning function to refine the musical ideas. In Task Two, students applied the synchronization function, inserting markers with the appropriate tempo to design the structure of the piece.

In the reflection stage of Task One, students edited the musical ideas between contextualized and humanized, and formalized and precise, as a decision-making process using the sequencing software. In Task Two, students edited the musical ideas between the two composing practices of aligned and structure, and contextualized and intuitive, as a particular decision-making process, using the sequencing software.

The similarities in how the students approached the two tasks during the creative process are presented in Table 7.1. In the exploration/imagination stage, students dealt with musical elements in both Task One and Task Two. In the application stage, students applied music technology to compose with a specific musical style in both of Task One and Task Two. In the reflection stage, students applied the skills of decision-making in the editing process in both tasks. Students experienced the need
for problem-solving skills in connecting musical ideas between sections with the experience in musical thinking in Task One and experienced problem-solving in aligning between visual image and music with the experience in creative thinking in Task Two. Both tasks involved the revision of the work as the final stage into the creative products.

To conclude, what was most revealing was the richness of each student’s personality that emerged in research question 1. In terms of data collected for research questions 2 and 3, the most notable finding was that all of the students were able to extract knowledge and experiences acquired during the composing sessions and apply them when responding to the questions. This indicates the importance of informing and involving students, and the level of transfer that can take place between theory and practice. The patterns that emerged were found mainly in the analysis of data for research question 4. The conclusions from the computer-assisted composition and multimedia composition were compared and contrasted with the literature that was reviewed in chapter 3. Implications for further research and recommendations in music education will be discussed in the conclusion chapter.
CHAPTER 8
CONCLUSIONS AND RECOMMENDATIONS

This chapter is divided into four sections. The first section includes the curriculum context in Hong Kong, objectives, background, and methodology of the study. The second section presents a summary of the research, the significance of the findings and the limitations in this study. The third section discusses the implications for research and makes suggestions for further research. The fourth section deals with the implications of the study, makes recommendations concerning music education and presents the conclusions.

8.1 INTRODUCTION
Experience in music technology and composition is supported as worthwhile instruction activities by music education professionals in the Hong Kong New Secondary School (NSS) curriculum (2005) from Secondary 4 to Secondary 6 and the music curriculum guide from Primary 1 to Secondary 3 (2003). Curriculum changes make the link between music technology and composition become more apparent. From the review of literature, it was evident that the understanding and encouragement of the development of the student-composer is insufficient. One reason for this disparity is that little guidance is currently available to music educators, either in the field or in training, about ways to go about structuring and framing computer-assisted composition activities and multimedia composition activities. This study sought to understand how students use music technology to compose, from an individual and developmental perspective.

The setting of the study was an exploratory, primarily self-directed environment in
which students determined the musical decisions about their compositions. Ten students were selected in the preliminary survey from 45 (year two) music major students from the Associate of Arts (Music) Degree program in the Hong Kong Institute of Education (HKIEd). Within this environment, multiple sessions allowed for a revisiting of what was created in previous sessions. Various predetermined factors provided a structure: (1) the software program, (2) the number of sessions, (3) the length of time per session, and (4) the instruction and teaching approaches given to the software program through musical elements.

The composing activities occurred over 15 sessions. The first phase from lectures 1 to 7 was primarily computer-assisted composition. The second phase from lecture 8 to 15 was primarily concerned with multimedia composition. During this one-year module, students attended lectures every other week in order to allow for sufficient time to compose in the laboratory or at home; this arrangement also allowed time for the students to explore, make decisions and evaluate those decisions. The four sources of data included: (1) written reports with musical analysis after the creative process, (2) individual interviews during and after the creative process with 15 questions in each phase, (3) self-reflective journals during the creative process, and (4) MIDI file observation after the creative process. Among these four data sources, commonalities from each data source were analyzed and there emerged a developmental pattern during the creative process that extended the model of Webster (2003) in creative thinking in music. The relationships between the findings and the literature review were presented to reinforce the thinking model, trends, and perspectives from different researchers.

Through an analysis of the students’ creative processes and strategies that occur while
composing with music technology, research projects such as this one may provide composers, music technologists and music educators understand how students approach composing using music technology. This information may prove useful when providing guidance for music educators as to how to structure computer-assisted and multimedia composition across ages, in secondary to university level music programs.

8.2 SUMMARY OF THE RESEARCH

8.2.1 Task One (Computer-Assisted Composition)

Responding to research question 2, students recorded their musical ideas into the sequencing software by shifting between two kinds of composing practice—playing and/or listening with different musical elements: theme (melody and rhythm), harmony, form, instrumentation and texture in the exploration stage. In this stage, different musical ideas were recorded into the software by music notation or MIDI keyboard. From the findings of the written reports, scales and motives were decided while writing the theme. In terms of harmony, an initial harmonic progression was mostly considered. In terms of instrumentation, different instruments could be chosen through sound modules or samplers. The process was not limited by particular cultures or the availability of instruments. In terms of form, consistency was important in the structure. In terms of texture, any kinds of layering were possible in computer-assisted composition.

In the application stage, students elaborated their musical ideas in the sequencing software by shifting between two kinds of composing practice—improvising and/or evaluating with music technology. Students could improvise on the MIDI keyboard while they were composing and evaluating the composition with the notation
In the reflection stage, students revised their compositions by listening to the sample of the instruments. During the decision-making process, the students continuously worked on the creation by shifting between the two categories: formalized and precise, and contextualized and humanized. In the problem-solving process, students developed musical thinking by organizing musical elements in the task and then provided solutions to link or connect musical ideas.

**8.2.2 Task Two (Multimedia Composition)**

Responding to research questions 1 and 3, the students recorded their musical ideas onto the computers by shifting two kinds of composing practice—synchronizing and/or associating the visual images with different musical elements: theme (melody and rhythm), harmony, form, instrumentation and texture in the imagination stage. In this stage, visual images were described and entered into the computer by inserting the markers on the sequencing software. From the findings of the written reports, the key center and motives were decided while writing the theme.

In the application stage, students elaborated their musical ideas in the sequencing software by shifting between two kinds of composing practices—composing and/or aligning with music technology. Students could decide on the treatment of the visual stimulus while they were composing and aligning the composition through the sequencing software. An overall musical style was chosen and an appropriate tempo was selected in this stage.

In the reflection stage, students revised their composition through listening to the
sample of the instruments and watching the movie on the computer screen. During the decision-making process, the students continuously worked out the creation between these two categories: aligned and structure, and contextualized and intuitive. In the problem-solving process, students developed divergent thinking by composing different versions of music to the same movie in the task. Convergent thinking and divergent thinking were particularly emphasized by Webster’s creative thinking model. After all, composing with visual images was an open-ended task. The solution to the problem could be infinite because the treatment of the visual image in music was unknown until the students came up with the creative product at the end.

The findings revealed throughout this study provide a starting point for discussions around various topics. At this point, however, care should be taken when generalizing to larger groups of students at the same level. Only 10 students were involved in the present study, and the selection of students was based on a preliminary survey. The discussions and implications, therefore, will focus on what was found within the confines of this study.

8.2.3 Findings of Task One

In chapter 6, the details of the developmental patterns during the creative process in computer-assisted composition were explained explicitly. The findings are summarized as follows:

1. Students developed the theme with harmony, rhythm, instrumentation, textures and improvisation.

2. Students continuously switched between two perspectives: playing and improvising on the keyboard, listening and evaluating from the software.
3. The benefits of the computers were that the students could save their file as MIDI files in real sound rather than notation to enhance the creative process at the first stage for musicians to be composers.

4. Musicians would think of creating sound more than creating notation.

5. By using computers, students could further work on the details of the composition.

6. The quantize function was a great tool for the rhythm section and complicated rhythms.

7. Mixing and panning functions created a new musical-spatial element in using music technology to compose.

8. The complexities of the composition would not be limited by the level of competence in performance of the students.

9. Students developed problem-solving and compositional techniques by organizing musical elements in the task and providing solutions to link up or connect musical ideas between sections.

10. Students continuously worked out the creation of shifting around the two categories: formalized and precise, contextualized and humanized. The decision-making process was an aural perception of sound. This would enhance the accuracy and realism of the creative product/music composition.

The abovementioned findings revealed that music technology provided the connection between creating sound and creating notation. The functions of the sequencing software affected the decision-making process in the aural perception of sound. Furthermore, students developed their problem-solving technique through providing solutions to link up musical ideas between sections.
8.2.4 Findings of Task Two

The details of the developmental patterns during the creative process in multimedia composition are summarized as follows:

1. Students preferred to use their imagination and intuitive thoughts to approach the visual images.
2. Students could concentrate on the creative and musical thinking process since the software could easily align the movie with the music.
3. Students continuously changed between two perspectives: synchronizing and associating. The decision-making process involved the student choosing an overall mood of the scenery or mapping of musical accents in structure.
4. Students worked with different musical styles in order to align the visual stimulus with the musical accent.
5. Musical styles became the most important issue in the decision-making process.
6. Students decided on the appropriate tempo in order to fit most of the sync points into the down beats or strong beats in synchronizing.
7. Students continuously worked out the creation of shifting around the two categories: aligned and structured versus contextualized and intuitive.
8. Students used the tempo to shift the time frame to fit the downbeat of the music as a musical accent and used the software markers especially to figure out the tempo and structure of the piece.
9. Students were concerned with musical style and mood in multimedia composition.
10. Students decided on the style with their intuitive thoughts and they edited the length in each section and connected different musical ideas to fit the music into the context.
The abovementioned findings revealed that music technology provided the connection between visual images and music. The functions of the sequencing software affected the decision-making process in the overall mood of the scenery or mapping of musical accents in the structure. Furthermore, students were concerned with musical style and mood in multimedia composition to fit the music into context.

8.2.5 Limitations of the study

In studying the student’s creative process, strengths and weakness of the research design are discussed in this section. In the end, the strength of the qualitative sampling design was to specify minimum samples based on expected reasonable coverage of the phenomenon given the purpose of the study. In-depth interviews and MIDI observations provided different thinking skills emerging from these two different tasks. However, the weakness of the qualitative sampling design was the small sample size problem. Studying ten participants’ compositions would be difficult to overgeneralize the situation.

The validity issue was mentioned in the methodology chapter. The availability of the software will directly have an effect on the research findings. In this study, sequencing software, *Sonar* was adopted and *Finale* was also provided for notation purpose. In the research design, the selected participants were from two groups of classes to minimize the differences. Both the keyboard major and non-keyboard major were selected to reduce the need in relying MIDI keyboard as the major source of compositions. Furthermore, a mixture of male and female participants were selected from the preliminary survey to avoid the discrimination.
8.3 IMPLICATIONS FOR FURTHER RESEARCH

Based on the results of my study, several recommendations are offered for alterations to the design of the study if it were replicated for further research, implications for further research, and a proposal for a subsequent research design.

8.3.1 Techniques Employed in Data Collection

Decisions made about how to collect data when attempting to discern creative processes were based on the review of the literature and an extraction of those techniques that were deemed compatible with what was sought. Those techniques included MIDI file observation (Folkestad, 1996), interview techniques (Younker, 1997), and self-reflective journals (Schon, 1987). Suggestions are given when employing two of these techniques: observation and interview procedures.

The literature emphasized the importance of the observation of students’ compositions. This technique gives the researcher a first-hand experience in observing students’ compositions. During this time, notes of what occurred, and reflections generated as a result of those observations, could be recorded. Furthermore, MIDI files allow the researcher to revisit and enhance the observational experience at a later date. Again, notes can be taken and reflections generated as a result of the observations recorded. One kind of observation technique needs to be chosen and adhered to throughout the data collection process. If the researcher does not feel confident that this technique can be adhered to, then perhaps another researcher should be asked to be present to oversee the running of the MIDI equipment, or to see that the procedures are set up and put into effect as planned.
8.3.2 Utilization of Music Technology

Using technology when asking students to compose, empowers the students in many ways, ways that were discussed in chapters 1 and 2. Several points are suggested for reflection. One is related to time, that is, the time needed to ensure that the students are proficient in and comfortable with, the capabilities of the software and hardware. Although many students have experience with computers, not all have any experience with music software programs. If the student has not gained all of the capabilities then two issues arise:

1. the need for facilitation, and
2. the non-use of many of the editing features.

The interjection of facilitation needs to be monitored to ensure that the musical decisions are generated by the student’s thinking and not by the facilitator’s suggestions. In the present study, this constant monitoring was noted. The other issue concerns the relationship between the quantity and quality of expressive decisions made while composing, and unfamiliarity with the software features. Both quantity and quality may be affected by lack of retention about the software capabilities. In the present study, there was a range, in terms of quantity and quality, of decisions made.

The utilization of music technology illustrates the point that a sequencer program, such as the one used in the present study involves a transformation of knowledge and skills used in the traditional ways of composing music. Therefore, questions may be asked as to how different software, not based on traditional transfer of data via a keyboard, would affect the outcome with respect to ways of creating music, and how the computer is used. Whatever the prerequisites are, it may be assumed that there is a good deal of variation in the ways of executing the tasks. It might be, though, that
other types of software and hardware in which the creation of music is done in an unconventional way, for example, the Hyperinstrument project (Jennings, 2003) explores concepts and techniques to help advance the future of musical composition, performance, learning, and expression. Through the design of new interfaces for both professional virtuosi and amateur music lovers, the development of new techniques for interpreting and mapping expressive gestures, and the application of these technologies to innovative compositions and experiences. The latest development of Hyperscore project (Jennings, 2003) suggested graphical computer-assisted composition systems for users with limited or no musical training. It takes freehand drawing as input, letting users literally sketch their pieces. Therefore, such a program would offer a more equal point of departure, because it would possibly force all the participants to use the computer in a more exploratory way.

8.3.3 Understanding of Creative Process

There is a need for further research in the study of the creative process in music composition to understand the decision-making process of the students. This would further explain the intention of the student's composition. The reasons behind the sound seem exploratory during the first stage of the creative process in this research. Further research will include explaining the reasons behind a musical decision. The research methodology could be extended to the qualitative feedback to explain the intention, the use of portfolio assessment, peer feedback to the creative product, or interactive assessment between teachers and students.

8.3.4 Origin of Musical Ideas

During the interview concerning the compositional task in this research, the aim was to investigate how the creative process was perceived by the participants. A question
was asked to the participants in how the musical ideas were raised. The need for further research includes how musical ideas develop from a student perspective. Some students mentioned that their musical idea was forgotten during the creative process. The use of music technology can be a great tool for them to capture the musical ideas instantly. It can be extended to investigate how the participants develop their musical ideas into a musical style as a composition task. However, the model of a certain musical style of composition has to be given to the students before the commencement of the research.

8.3.5 Suggestions for Further Research

There appears to be a need for further research with a focus on exploring the differences between primary school, secondary school and tertiary level students in using music technology to compose. The results from this study indicated the creative process of computer-assisted composition and multimedia composition for music majors at tertiary level. It can be extended to cover secondary school students without any musical background and primary school students without any instrumental background. Students came with varying degrees of ability and background. As a result, the differences reflected various aspects of their composing behaviours. These differences have been noted here and extended to further research to enhance teaching and learning in using music technology to compose in the secondary and primary school curriculum.

In terms of further research, comparative studies may shed additional light on the developmental patterns border between novice composers and expert composers. This border was considered in the literature review, and has been revealed in studies of both children and adults who compose, and studies of how professional composers
compose. The comparative study between the creative process with and without using visual images in composition was noted in the conclusion of the analysis chapter. It could be extended to a comparative study between novice and expert composers in computer-assisted composition or film-scoring projects in the future.

Another area of research that warrants investigation is the additional process-product study (Hickey, 1995). When the creative process is the focus, certain structural components of the music may not be examined, thereby not revealing a complete picture of the student’s interaction with the music.

Furthermore, the relationship between listening preferences and composing behaviours warrants investigation, especially with reference to musical styles. To understand the enabling skills and enabling conditions, further research in investigating how listening preferences affect the creative process of composition and what kind of enabling skills and conditions are required to compose in a certain kind of musical style in the composition.

Lastly, an area of research that also warrants investigation includes studies in which composing behaviours are analyzed quantitatively. These studies may reveal more information about the time spent on different composing processes (Kratus, 1989) as well as the time spent on each musical element. Do certain musical elements receive more time with specific processes? Are these consistent across primary, secondary, and tertiary levels? The more we understand about the activities, the better will be the teacher’s role as facilitator in the field.
8.4 IMPLICATIONS FOR MUSIC EDUCATION

The implications from this study for music education include the 1. shift the paradigm in teaching and learning, 2. model application, 3. current practice, 4. future practice, and 5. suggestions for using music technology with sequencing software in teaching and learning at university, secondary school, and primary school levels.

8.4.1 Shift Paradigm in Teaching and Learning

One obvious question is how the findings of the present study might be used in implementing music composition by means of music technology in primary, secondary and tertiary levels. In the Literature Review, the adoption of computer and music technology is shown to be well established for professional use among musicians and composers. The way of using the equipment for students is important when it is contextualized with the social and cultural environment and integrated into the school curriculum at primary and secondary school level and course development at tertiary level. Therefore, when placing these activities into the school context, it is important to ensure that the functions, conditions, and driving force of the creativity and originality are not lost and that the educational and musical significance are not undermined.

In principle, the present study is similar to an open-ended situation in composing music. Teachers and students search for new ways of solving problems together—a situation which is more characterized by the informal learning situation than the traditional teaching situation. The difference between formal and informal educational situations can be described as follows: formal teaching in school is often characterized by the paradoxical situation in which the person who knows the answers (the teacher), asks the questions, and the students, who do not know, are supposed to
answer. However, in informal learning situations outside the school it is the reverse, if one has a question and needs an answer, one formulates it, and someone who knows will give the answer.

Quite often when the teaching is functioning well, the teacher has succeeded in creating a situation very similar to the one in informal learning situations. When teaching works well, the students have forgotten that they are in school, and the learned patterns of behaviour in the teacher-student relationship dissolve. Instead of being teachers and students they meet as people who are together in a mutual learning situation. One important feature of these situations is that both the experience of the students and the teacher are acknowledged as important.

Various ways of working in recording studios have been developed as a result of new technology. Therefore, the relationship among engineers, producers, composers, and artists in the process of creating, producing, and recording popular music is constantly in a state of change. A fruitful way of finding new ways of working in educating students and musicians might thus be to study situations in the real world similar to the one in a recording studio or in a music group composing music collectively.
8.4.2 Model Application—Pedagogy in Computer-Assisted Composition

The pedagogy of computer-assisted composition includes: 1. create as sound objects rather than notational symbols, 2. setting different types of tasks, 3. teaching of musical styles, 4. teaching of musical elements, 5. teaching direct experience to the students, and 6. creative thinking and musical thinking.

1. Create as sound objects rather than notational symbols

Paynter (2000) defined the word composing as meaning positioning things together and as occurring when someone who has tried putting sounds together is pleased with the results; pleased enough, that is, to remember them. In the creative process model of computer-assisted composition, this implied that the benefits of the computers were that the student could save their file as a MIDI file but as real sound rather than notation. Musicians would think of creating sound more than creating notation. Then the instructor can start to teach mainly by asking questions about what is presented. It is important to comment on what we hear rather than on what we see notated. The pedagogy of computer-assisted composition is about sound objects rather than notational symbols. However, if the students rely on the real sound which is produced by the sound module during the creative process, it will possibly weaken the use of inner hearing in computer-assisted composition. In the future, further research is needed to investigate this issue. Furthermore, the quality of the samples of the instruments is the major concern in the computer-based creative music environment. The equipment of the computer music lab has a direct impact to the quality of the music composition.
2. Setting different types of task

Burnard (1995) documented the results of another important research study in the design of a composition task. Three types of task were demonstrated. A prescriptive task involved a high degree of control, in which students were given specific instructions on instrumentation, genre, and length of the work, formal structure, and tonal structure. The choice task incorporated two different types of activities. The first offered a less specific range of options with only one constraint – an ethnic piece of non-Western style; whereas the second required students to compose for an instrumental ensemble using either a set of variations to a given tune, a piece in rondo form or a chamber ensemble. The freedom task was the fourth type which provided a totally open-ended composition for voice(s). In the creative process model of multimedia composition, it implied that the Task Two with visual images could be a stimulus, but could also be a restriction on the students when they were composing. It was close to the prescriptive task mentioned by Burnard. In the creative process model of computer-assisted composition, it implied that Task One was close to the freedom task. It is important for the instructor in composition to keep in mind that different types of tasks should be included to cater for the different needs of the students.

3. Teaching of musical styles

Bennett (1976) suggested that the fostering of experience in music composition carries important educational considerations. Developing germinal and internal musical ideas relies heavily on long-term memory and experience. Thus students cannot be expected to compose in a style or medium that is unfamiliar. In the creative process model of computer-assisted composition and multimedia composition, the musical style was crucial according to the students in both tasks. It implied that the
teaching of musical styles was recommended in the teaching and learning of composition.

4. Teaching of musical elements

(a) melodic contour lines—students start their composition with a melodic line in the creative process of computer-assisted composition. Once the students record the theme, the melodic contour line is shown in the sequencing software with piano-roll view. Then the student can adjust each note through the staff view by using the keyboard or the mouse. The development of the melodic contour line is clearly demonstrated with the assistance of computer software in teaching and learning composition in the exploration stage.

(b) rhythmic patterns—students can use drum sets or percussion instruments as part of the rhythm section in their compositions. Through MIDI drums and percussion, MIDI channel 10 is allowed to record each part individually and play it back instantly. The students will be able to mix it together in the final stage with the panning functions. Therefore, the teaching of the rhythm section is more realistic to enhance the students’ musical experience.

(c) graphic textures—turning each melodic line into graphical notation is an effective tool to teach different kinds of texture. The building of a texture is mainly from the layering of tracks. The complexities of the textures are increased when more and more tracks are layered. It allows the student to create some textures that are not limited by traditional compositional techniques.
(d) form and structure—the sequencing software allows the student to be able to view the whole piece in a tracks view option. The longer the piece the student is composing, the more time they would spend in designing the form and structure. Also, the structure of the piece is not limited by the conventional form if the structure is shown on the computer screen in the creative process.

(e) combining timbres—the software can provide opportunities for students to experiment using different combinations of tone colours. The timbral modulation can be applied to the manipulation of sound envelopes. The possibilities of combining sounds can be further developed in the later stage of the creative process in computer-assisted composition.

(f) reharmonization—different kinds of style require different kinds of harmonization technique. This study reveals that students tend to start their composition with a series of harmonic progressions. The teaching of reharmonization techniques can be applied in composing with different styles of music.

5. Teaching the students direct experience

The creative process of the model also suggested that students must be made conscious of the various aspects and operations inherent in producing a creative product. Students would need guidance and practice in monitoring their own creative musical behaviour. This means that students must have the opportunity to listen to their compositions in both draft and final forms. Computer-assisted composition provides an environment in which students could listen to their composition instantly. It enhanced the creative process of the students, particularly those who did not have
much musical training. By allowing the students to directly experience the results of
their composition via the computing medium, some significant music learning takes
place as musical ideas are tried, amended, and refined in different stages.

6. Creative thinking and musical thinking

Composition as a thinking process provides learners with a means of applying a wide
variety of cognitive operations to musical, conceptual, and skill areas. In the creative
process of computer-assisted and multimedia composition, students develop problem-
solving and compositional techniques in the reflection stage. In Task One, they
develop musical thinking through organizing musical elements in the
computer-assisted composition and provide solutions to link up or connect musical
ideas between sections, because most of the students encounter problems with the
fragmented musical ideas. In Task Two, the decision-making process was that the
student could choose an overall mood of the scenery or mapping of musical accents in
structure as convergent thinking and divergent thinking in the creative thinking model
by Webster. The treatment of visual stimulus as musical accents was unlimited. It
allowed students to treat the images with no definite answer in using music
technology to compose.

8.5 CURRENT PRACTICE

8.5.1 Computer-Based Creative Music Environments

As mentioned earlier in this chapter, most of the learning tool applications of music
education reflect a teaching and learning style which may be described as generally
speaking, having its pedagogical foundations in the cognitive-developmental learning
theories of psychologists such as Piaget and Gardner. Recently, computer-based
creative music environments have been most frequently employed in the general classroom music of music education with an emphasis on non-skills-based music learning in composition and performance.

These programs are capable of alleviating the skills-based nature of the creative musical process. From the educational perspective, composition may allow for the development of aspects of musicality which are not directly dependent on prerequisite performance and musical literacy skills.

From the findings of research questions 1, 2 and 3, a fairly high degree of intuitive musical knowledge is found in aural discrimination, musical preferences and musical responsiveness. These have been acquired through a process of enculturation which is growing up in a society that includes the impact of mass media and familiarization with musical styles. Our enculturation may include popular music, jazz, or European classical music, Indian music, Chinese music, Japanese music, Indonesian Gamelan music, and so on. All these different cultural elements were experimented with or integrated during the creative process of computer-assisted composition and multimedia composition.

The direct experience in computer-assisted composition should not ignore the audiation process. The instant feedback facility should be used to confirm the accuracy of mental hearing and to listen acoustically to the effects of a musical idea in a broader musical context. The quantizing and mixing functions could foster the audiation or mental hearing process of the students in the sequencing software when they are improvising on the MIDI keyboard. The benefits of music technology can therefore be fully utilized in having the internalized music confirmed by some form of
actual audio realization. It can also develop the compositional skills in students for student composers to be able to share their ideas in sound and engage in constructive discussions concerning their music with their peers and with their teachers.

Moreover, the ability to employ notational software within a computer-based compositional environment fosters a student to “think musically” by requiring the student composer to breakdown the decision-making process of composition into a series of small steps which have to be entered by keying in individual musical elements. Entering the notes using notation makes significant demands on the students’ ability to construct and hold an internalized vision of the composition on which they are working. The complex process of editing will stimulate the student to develop the capacity to think in sound in a detailed way.

At the same time as decreasing the formal musical skills demanded of student composers, a computer-based compositional environment is also able to greatly empower the students musically by allowing simultaneous control over different musical elements in the exploration stage. By stimulating a multidimensional performance situation, the computer enables the students to control the basic elements such as pitch, duration, dynamics, tempo, timbre, texture and form. This fosters multidimensional thinking in music and also allows for concentration on individual musical elements.

8.6 FUTURE PRACTICE

8.6.1 Computer-Based Music Curriculum

In the proposed new secondary school curriculum and assessment framework in Hong Kong (2005), the three compulsory modules of this curriculum: (1) Listening, (2)
Performing, and (3) Creating are designed to develop students’ creativity, critical response, and all round musical competence, whereas the three elective modules allow students to specialize in an area of their interest and strengths. In the module of creating, computer-based music workstations could enhance the teaching and learning of composing and arranging, as various research studies (Reese, 2001; Purse, 2003; Leong, 1995; Kersten, 2004) showed in the literature review. The computer linked with a synthesizer can provide these opportunities. The music computer workstation provides all students with multiple quality learning experience opportunities rather than restricting some students.

Computer-assisted composition can be a new source for teaching and learning in the new curriculum in the compulsory module: Creating I. Students are able to (a) compose their own piece, and (b) rearrange a new piece using reorchestration, reharmonization and/or developing variations using the notation and sequencing software. Furthermore, MIDI files can be saved at different stages to show the development of the piece as observation in c) to write a self-reflective report. Finally, the creative product can be saved in both MIDI format and MPEG format as the sound recording. The score could be edited in the notational software and printed as a professional score.

Computer-based instructional software can provide tutorials and programs for music theory, music history, aural skills and composition. The use of computers in music education creates a powerful new link between the student and teacher. It enables all students including those with limited musical experience to achieve success in improvisation, arranging, and composition. MIDI applications in music education are mostly adaptable in the multimedia computer laboratory (MMLC) in the secondary
and primary schools in Hong Kong. These laboratories can be expanded by using MIDI keyboards, sequencing and notational software. The teacher can monitor, assist, and instruct from the master keyboard. Demonstrations can be requested by student messages through the master’s amplified speaker system. The computer-based music curriculum is capable of offering students training in a variety of skills. This process results in students staying on task, being self-motivated (Cheung, 2001) and increasing self-esteem (Merrick, 2003) by sharing their excitement with peers. This motivation becomes a major driving force behind individual and group projects.

8.6.2 Hyperinstruments as Musical Interfaces
At present, most of the music technology relies on the MIDI keyboards, controllers, notation or sound programming. The Hyperinstruments Group explores concepts and techniques to help advance the future of musical composition, performance, learning and expression. Through the design of new interfaces for both professional virtuosi and amateur music lovers, new techniques for interpreting and mapping expressive gesture are developed. Technologies promoting innovative compositions and experiences are applied to enhance music as a performing art. The scope of the research includes musical instrument design, concepts for new performance spaces, interactive touring, and permanent sound installations and music toys for hyperscore. It extends traditional forms such as Brain Opera and Toy Symphony.

8.6.3 The Evolution from MIDI to Audio Editing
Digital audio and MIDI have undergone a vast development in the last decade. Digital audio workstation (DAW) software such as Digital Performer, Cubase, Logic, and Sonar are equipped with software plug-in synthesizers, samplers, and virtual instruments. An all-in-one virtual studio software and programming environment is
emerging, with features including sound shaping and synthesis to create and combine sounds. Any DAW software can make an original audio recording called a *clip*. The clip will remain in the pool of resources, unaffected by the editing that takes place. However, when the clip is part of the track window, it becomes an *event* or *sound object*. The MIDI data and digital audio in an integrated environment is a real advantage in composing and arranging music. A virtual mixer is provided for automation and volume adjustment. It has an option to add a track for a surround sound set-up. The use of audio interface will therefore increase in the coming five years. The use of music hardware such as the effect processor and the mixer will decline.

### 8.6.4 Mobile and Laptop Technology

The use of laptop computers will increase in the coming five years because most of the DAW software is completely integrated with MIDI, and with audio and software synthesizers. All that is necessary is a MIDI controller, such as a USB portable MIDI keyboard and/or an audio interface for recording live instruments. Students could bring their own laptop computers with headphones and the school can provide the software and portable MIDI keyboards to easily set up a computer-based creative music environment in any music classroom or lecture theatre. The budget will be much lower than spending money to set up 20 music workstations as a laboratory like in the past.

### 8.6.5 The World of Multimedia

In analyzing musical multimedia, Cook (1998) shows how music, words, movies, and dance work together to create multimedia, for example, the *Rite of Spring* in *Fantasia*, Madonna’s music video *Material Girl*, the film *Armide* to the opera *Aria*. The trend
toward multimedia has been developing vastly in the last two decades. The use of sequencing software could align the movie, computer animation, or video with music into a creative product. The application of creative thinking in multimedia composition was demonstrated in chapter 6. It could further push forward into the development of digital film scoring in music production with implications for teaching and learning in film music.

8.7 CONCLUSION

To conclude, it has been suggested that there are many advantages associated with the use of music technology in composition in two aspects: (a) musical development, and (b) teaching and learning. Many of the claimed advantages in musical development aspects may be justified on the basis that the computing medium with sequencing software is able to:

1. foster multidimensional thinking in music by allowing simultaneous control over different musical elements;
2. encourage students to “think musically” by requiring the student composers to breakdown the decision-making process of composition;
3. develop the accuracy of mental hearing and to hear acoustically the effect of musical ideas in a broader musical context;
4. develop the understanding and application of different musical styles in the compositional process;
5. foster the enculturation of different musical styles, such as popular music, jazz, or European classical music, Indian music, Chinese music, Japanese music, Indonesian Gamelan music, and so on.
The other claimed advantages in teaching and learning aspects may be justified on the basis that the computing medium with sequencing software is able to:

6. foster the approach of a participatory, active, discovery-based, open-ended, and student-centered teaching and learning style;
7. encourage the innate musical creativity of students by allowing them access to a computer-based creative musical environment;
8. foster pedagogically desirable relationships between the auditory and visual stimulus in composition;
9. develop convergent and divergent thinking in the decision-making process concerning alignment of visual stimulus and musical accent; and
10. foster the approach to music learning which correlates with the developmental perspectives in music education.

To conclude, students have contributed many musical ideas, experiences and much knowledge during this research study. As a musician, composer, or music teacher, one needs to observe the students thinking in sound, provide them with musical knowledge when appropriate, and then step back and guide them to make sense of their composing activities. Observing students compose, and asking them to tell us what they are doing, will help us to uncover strategies used and processes experienced as musical decisions are made. This knowledge can help us when deciding what musical knowledge support is needed and how should it be delivered.

Composing is a viable behaviour to understand music from the inside out. There have been many successful endeavors in the field of involving students in performing and listening, in which the students have experienced music. What they have not done to
the same degree is to involve students in making music from a composing perspective. Students’ compositions have to be celebrated as much as their performances. A word of encouragement from the instructor or composer to the student can be very effective.

The investigation into the creative process in composition should be continued until we know all the issues in applying music technology to compose.
References


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Appendix I

Plain Language Statement for the Focus Group Music Students
Plain Language Statement

I, Chen Chi Wai, am undertaking research for a Doctor of Philosophy degree within the Department of Industry, Professional and Adult Education of Royal Melbourne Institute of Technology (RMIT University). My research project title is “The creative process of computer-assisted composition and multi-media composition—visual arts and music”. Dr. David Forrest, Associate Professor in the School of Education of RMIT University, is my supervisor.

The purpose of the study is to observe, record and analyze the enhancement of student's creativity using music technology. The potential benefits to both the participant and contributions to the general body of knowledge are mainly to examine the factors that change the decision-making of composers in the creative process with the integration of visual image and music in composition.

In this study, 10 students will be selected by the instructor from Associate of Arts (music) degree in the Hong Kong Institute of Education among 45 participants. Students are free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied. The researcher decides a continuous teaching unit for about 15 lectures in this study. The program will be implemented in the form of a serial teaching and learning activities of the Multi-media music project. Students will participate in post interviews. The project is for the purpose of research and/or teaching. It may not be of direct benefit to the researcher.

The security of the research data is assured during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided by Mr. Chen, Chi Wai. The sessions will be video recorded. Any information which will identify the participant will not be used.

Thank for your cooperation.
研究聲明
Plain Language Statement (Chinese Version 1/1)

本人(研究者)陳智偉(香港教育學院音樂副學士課程統籌主任)，現於澳洲皇家墨爾本理工大學，工業、專業及成人教育系就讀哲學博士學位。博士研究題目為「多媒體電子音樂作品的創作過程」，研究指導教授為該系副教授David Forrest博士。

本研究目的在分析及觀察學生怎樣利用電子音樂發揮創意思維。藉本研究，希望能對學生的創作模式及判斷能力作出深入的分析及探討，亦希望能建立一種結合視覺影像和音樂創作的新方向，以配合未來對音樂製作及音樂教育的需求。

本研究於香港教育學院進行，對象是音樂副學士學生四十五人中選出十人作研究；被選學生可以自由隨時停止參與是項計劃及提供相關研究資料。研究人員將設計的十五節課堂的連貫性教學單元為主，以多媒體電子音樂創作進行教學，計劃本身只作研究或及教學用途，而研究結果並不一定對研究者產生助益。

個人資料方面將會保密，只有在父母或監護人的同意下或法律要求下才可把個人資料公開。教學過程將會被錄影。研究數據在研究過程中和過程完成後將會得到安全保密，並作爲研究者本人(陳智偉)研究論文結果及出版之用，任何有關能指認出學生身份的資料將不會被採用。

謝謝合作！祝安！

陳智偉謹致

研究員簽名：陳智偉，B.Mus., M.A., Dip.Ed.
Signature of the Investigator: Mr. Chen, Chi Wai

30 Sept, 2003
Investigator

Name: Chen Chi Wai
Qualifications: B.Mus. University of Missouri-Kansas City Conservatory; M.A. in music composition; Dip.Ed. Hong Kong Baptist University
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Degree (for which research is undertaken) PhD

Supervisor

Name: David Forrest, Associate Professor
Qualifications: PhD
Department: Industry, Professional and Adult Education (RMIT University)
Campus: Bundoora
Address: PO Box 71, Bundoora 3083, Victoria, Australia
Phone: 9925 7831
Email: David.forrest@rmit.edu.au

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (613) 9925 1745. Details of the complaints procedure are available from the above address.
Appendix II

Consent Form For Music Students

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**RMIT HUMAN RESEARCH ETHICS COMMITTEE**

Prescribed Consent Form For Persons Participating in Research Projects Involving Interviews, Questionnaires or Disclosure of Personal Information

**FACULTY OF**

Education, Language and Community services

Industry, Professional and Adult Education

**DEPARTMENT OF**

**Name of participant:**

**Project Title:**

The creative process of Multi-media composition-visual arts and music

**Name(s) of investigators:**

(1) Chen Chi Wu

(2) 

**Phone:**

852-2190-8576

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1 I have received a statement explaining the interview/questionnaire involved in this project.

2 I consent to participate in the above project, the particulars of which - including details of the interviews or questionnaires - have been explained to me.

3 I authorise the investigator or his or her assistant to interview me or administer a questionnaire.

4 I acknowledge that:

(a) Having read Plain Language Statement, I agree to the general purpose, methods and demands of the study.

(b) I have been informed that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied.

(c) The project is for the purpose of research and/or teaching. It may not be of direct benefit to me.

(d) The privacy of the personal information I provide will be safeguarded and only disclosed where I have consented to the disclosure or as required by law.

(e) The security of the research data is assured during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to the participants (researcher to specify). Any information which will identify me will not be used.

(f) I will be audio and video recorded.

---

**Participant’s Consent**

**Name:** 

(1) 

(Participant) 

Date: 

**Name:** 

(2) 

(Witness to signature) 

Date: 

---

**Where participant is under 18 years of age:**

I consent to the participation of 

in the above project.

**Signature:**

(1) 

(Signatures of parents or guardians) 

Date: 

**Name:** 

(Witness to signature) 

Date: 

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Appendix III

Permission Form from the Division Head of the HKIEd

RMIT University Ethics Committee,

Permission has been granted for Chen Chi Wai, Jason to conduct research for his PhD study on "The creative process of multi-media composition - visual arts and music" at the Hong Kong Institute of Education (HKIEd) with students in the Associate of Arts (Music) Degree. The HKIEd supports this research and has no problem with students from HKIEd participating.

Signed by:

[Signature]

Dr. Edwin Wong
Head
Division of Continuing and Professional Education
Hong Kong Institute of Education
Appendix IV

Preliminary Survey Form on the Creative Multimedia Music Project
Preliminary survey on creative multi-media music project

Part I  Personal information

Name: ______________________

Age: ___  Sex: ___

Part II. Experience in playing keyboard instrument

Select from 1 to 4, which category you are belonged to:

1. a Piano major (pass or above ABRSM Grade 8) ☐

2. a Piano major (below ABRSM Grade 8) ☐

3. Non-keyboard major – have studied keyboard skills for more than one year ☐

4. Non-keyboard major – have studied keyboard skills for less than one year ☐

Part III. Experience in computer music sequencing software and hardware

5. Have you ever played with any computer music sequencing software? ☐ Yes ☐ No

If yes, please specify the name of the software: ______________________________

6. Have you ever played with any computer music sequencing hardware? ☐ Yes ☐ No

If yes, please specify the name of the hardware: ______________________________

Part IV Experience in studying composition

7. Have you ever formally studied composition with a private tutor? ☐ Yes ☐ No

If yes, write down the name of the tutor __________________________

Period of study: __________ year/s
Appendix V

Statement of Verification on the Accuracy of the Interview Scripts Translation
31st August 2004

To Whom it May Concern

This is to verify that the English version of the interview scripts of the study entitled
The creative process of computer-assisted composition and multi-media composition -
visual images and music is a true and accurate translation of the meaning and intent of
the Chinese version.

Signature:

Lecturer
Appendix VI

First Individual Interview Questions
Q.1 Did you start the composition with writing the actual notes on paper or record the notes through the keyboard onto the computer?

Q.2 Which way is easier for you?

Q.3 What musical elements did you consider the most important before you start to compose? For example, texture, melody, rhythm, form, harmony, instrumentation, etc.

Q.4 Did you choose the instruments from the sound module or choose it aurally in your head as the first step?

Q.5 What was the inspiration of your piece?

Q.6 Did you compose your piece with an intention or no intention?

Q.7 How did you turn your inner hearing into actual sound?

Q.8 What did you think of the ‘Quantization function’? Was that useful in the making of your own music and how it could enhance your work process?

Q.9 What did you think of the ‘Mixing and Panning function’? Did you find it useful to mix parts together?

Q.10 Did you find a particular style that you want to experiment in your piece before you compose?

Q.11 What did you think about the notion that the music technology could help transform the preliminary ideas into the actual sound?

Q.12 Did you start the piece with melody and accompaniment in homophonic texture, contrapuntal in a polyphonic texture or both?

Q.13 What did you consider the best way to compose with music technology?

Q.14 How would you regard as the piece of music completed?

Q.15 Did you have a particular visual image in mind while you were composing?
Appendix VII

Second Individual Interview Questions
Q.1 Do you think extramusical ideas can stimulate your composition?

Q.2 What did you think of the relationship between visual image and musical ideas?

Q.3 How did you find the ‘associated objects’ of the visual images?

Q.4 Did you built up a storyboard before you compose?

Q.5 What kind of mood did you associate with the visual images?

Q.6 Did you find the software markers helpful in composing during the creative process?

Q.7 How would you determine the appropriate tempo in the sequence?

Q.8 Do you think the software can integrate the movie and music at the same time?

Q.9 What musical elements did you consider the most important before you start to compose in this multi-media project?

Q.10 Did you have a particular musical style to fit the storyboard?

Q.11 How did you solve the problem when the music is not in sync with the visual images?

Q.12 How did you treat the “sync point” musically?

Q.13 Do you think the ‘musical accent’ can emphasize the ‘sync point’ in the movie?

Q.14 What is the limitation in music technology of this ‘Multi-Media project’?

Q.15 What is the overall impression of this project? Will you compose with technology later on after finishing this project?
Appendix VIII

CD-Rom One (Creative Product of Task One—Computer-assisted Composition)

In CD-R One, the file type is in MP3. format and it can be opened by Window Media Player.

CD-R One  Track 1: Student A: W. K. Kom
CD-R One  Track 2: Student B: P. S. Lam
CD-R One  Track 3: Student C: P. Y. Kam
CD-R One  Track 4: Student D: S. N. So
CD-R One  Track 5: Student E: C. L. Choi
CD-R One  Track 6: Student F: C. L. Yung
CD-R One  Track 7: Student G: C. H. Tang
CD-R One  Track 8: Student H: K. L. Lai
CD-R One  Track 9: Student I: M. F. Yeung
CD-R One  Track 10: Student J: E. S. Hunyh
Appendix IX

CD-Rom Two (Creative Product of Task Two—Multimedia Composition)

In CD-R Two, the file type is in DAT format and it can be opened by Window Media Player.

CD-R Two  Track 1: Student A: W. K. Kom (Version 1)
CD-R Two  Track 2: Student A: W. K. Kom (Version 2)
CD-R Two  Track 3: Student B: S. P. Lam (Version 1)
CD-R Two  Track 4: Student B: S. P. Lam (Version 2)
CD-R Two  Track 5: Student C: P. Y. Kam (Version 1)
CD-R Two  Track 6: Student C: P. Y. Kam (Version 2)
CD-R Two  Track 7: Student D: S. N. So (Version 1)
CD-R Two  Track 8: Student D: S. N. So (Version 2)
CD-R Two  Track 9: Student E: C. L. Choi (Version 1)
CD-R Two  Track 10: Student E: C. L. Choi (Version 2)
CD-R Two  Track 11: Student F: C. L. Yung (Version 1)
CD-R Two  Track 12: Student F: C. L. Yung (Version 2)
CD-R Two  Track 13: Student G: C. H. Tang (Version 1)
CD-R Two  Track 14: Student G: C. H. Tang (Version 2)
CD-R Two  Track 15: Student H: K. L. Lai (Version 1)
CD-R Two  Track 16: Student H: K. L. Lai (Version 2)
CD-R Two  Track 17: Student I: M. F. Yeung (Version 1)
CD-R Two  Track 18: Student I: M. F. Yeung (Version 2)
CD-R Two  Track 19: Student J: E. S. Hunyh (Version 1)
CD-R Two  Track 20: Student J: E. S. Hunyh (Version 2)