Chapter One

Conceptual Framework

The catalyst for this investigation of music listening behaviour in interactive multimedia music instruction (IMMI) originates from an affirmation of the widely held view that listening is the foundation of musical experience. The musical imagination that occurs in the minds of creative musicians can be notated on manuscript, but cannot be realised fully until it has been brought to physical existence through performance that creates vibrations in air particles which, when transmitted to the human brain via the ear, are perceived as sound. The physical transmission of sound provides a conduit for musical communication, enabling inner musical thought to be manifested and transmitted from its creative source to the listener. Reimer (1992) maintains that listening is the essential mode of musical experience - music cannot be experienced if it is not heard. Listening is a part of all aspects of musical involvement, whether through performing, composing, or as an activity by itself... the enhancement of listening ability is the primary function of music education, and listening must be taught directly. (p. 234)

Many commentators have identified listening as a core musical activity and the complex phenomenon of music listening has been widely investigated (e.g., Copland: 1939, Schoenberg: 1951, Hindemith: 1953, Langer: 1953, Meyer: 1956, Bernstein: 1968, Sessions: 1971, Sloboda: 1985, Gordon: 1989, Haack: 1992, Reimer and Wright: 1992, and Elliott: 1995). Some observers, such as Langer and Gordon, differentiate between two types of listening: physical or perceptual hearing and mental or inner hearing. Gordon (1989) has coined the term *audiation* to describe inner musical hearing. He suggests that to appreciate music fully, a person must *conceive* as well as *perceive* what is heard. According to Gordon, listeners may revel in the sheer sound of music, but without appropriate aural preparation and musical understanding they are unlikely fully...
to conceptualise musical works with aesthetic sophistication. Like Gordon, commentators such as Ulrich (1970), Meyer (1973), Serafine (1988), DeBellis (1995), Elliott (1995), and Jourdain (1997) hold that music listening occurs on different levels and that the quality of musical experience is dependent upon the level of listening. These observers often distinguish between *hearing* and *listening* to music. For example, Ulrich argues that hearing music does not necessarily imply attention or application, whereas listening to music does. This distinction between hearing and listening is refined by Elliott who refers to the two processes as listening *to* and listening *for* music respectively. Listening *to* music indicates a passive approach, whereas listening *for* music implies the active involvement of the participant. The concept of listening *for* something in music is not, however, a recent innovation. In advocating an active approach to music listening, Copland (1939) suggested that "...whether you listen to Mozart or Duke Ellington, you can deepen your understanding of music only by being a more conscious and aware listener - not someone who is just listening, but someone who is listening *for* something" (p. 23).

An active approach to music listening is one of the central tenets of contemporary methods of music instruction and modern music learning theory is often predicated upon the belief that music listening should precede the introduction of music notation (Serafine: 1988, Gordon: 1989, Bamberger: 1994, Elliott: 1995). Emphasis on the introduction of sound before symbol in contemporary music instruction practice can be traced to the principles of the Swiss educator Johann Pestalozzi (1746-1827) whose educational theories were adapted for music instruction by the American music educator Lowell Mason (1792-1872) in the 1830s (Mason: 1838, Costanza and Russell: 1992, Schleuter: 1997). The significance of promoting active music listening as a precursor to the introduction of theoretical musical concepts has become increasingly apparent during the twentieth century, partly as a result of the work of educational theorists such as Mursell (1943, 1948, 1958) who believed that direct listening experience should precede
theoretical explanation of musical concepts. This emphasis on active aural experience before the introduction of music notation and theory is further illustrated by the widespread adoption of the music instruction strategies of Suzuki (1969), Kodaly (1974), Jaques-Dalcroze (1976), and Orff (1978) which place listening at the foundation of music learning (Costanza and Russell: 1992, Walters: 1992).

Despite the emphasis by Gordon and others on inner hearing in the development of music skills, it remains that active listening, through the transmission of physical sound, is a key element of music instruction. Without the physical transmission of musical ideas through sound, music learning is limited to only the understanding that can be gained from the audiation of visual stimuli such as music scores, and to the development of kinaesthetic senses through rhythmic body movement. Consequently, there is widespread support for the view that the physical manifestation of sound and an active and attentive approach to listening are crucial elements which underpin contemporary music education practice.

**The Influence of Technology on Music Listening**

The widespread availability of recorded music has fundamentally altered the ways in which people listen to music as well as the types of music to which they listen. According to Abeles, Hoffer, and Klotman (1984) the fact that there is music virtually everywhere has encouraged people *not* to listen to it. They simply cannot give concentrated attention to all the music they hear each day, and often the conditions under which the music is heard are not conducive to careful listening. So people learn to ignore much of what they hear, just as they overlook sounds of traffic, a clock ticking, and so on. The fact that people acquire the habit of not listening carefully to music is perhaps the most detrimental effect of its mass availability. (p. 122)
While acknowledging the many benefits of audio reproduction technology, other commentators have reinforced this disquiet about the increasing prevalence of recorded music (e.g., Durant: 1990, Bontinck: 1991, Storr: 1992, Alten: 1994, Meyer: 1994). There remains widespread concern that the previously dominant culture of live music performance, which was present before the advent of audio reproduction technology, has been largely replaced by recorded music. Apprehension about the overexposure of recorded music is incisively summarised by Jourdain (1997) who notes that "where music once nourished a healthy appetite, whether in the concert hall or the village square, now a perpetual banquet of song serves only to soothe a blunted palate. We live in an age of widespread musical obesity" (p. 245).

The pervasiveness of audio technology means that listening to recorded music has now become the primary mode of musical experience for many people. Music serves as a perpetual background to daily activities in the home, at work, and in leisure pursuits. For example, Etzkorn (1990) has estimated that at any one time, as much as 80 percent of the sentient adult population may be exposed to recorded music in some form, while in a recent study of the use of music in retail settings in the United States of America, Sterne (1997) observes that more than one third of the American population is exposed to programmed music (such as Muzak) at some point every day. Furthermore, in his survey of the cultural history of background music, Lanza (1994) suggests that the term "background music" has become something of a redundancy "since all music is taking a background role" (p. 216). The prevalence of recorded music in the lives of children is no less pronounced than it is for adults, and many youngsters now spend a substantial amount of time each day watching music programs on television. A recent study of the television viewing habits of a group of North American adolescents revealed that 67 percent of subjects viewed an average of 50 minutes of music video per day (Ahn: 1996).
With so much attention focused on broadcast and recorded music of varying quality, it is increasingly important that music educators devote even more effort to understanding music listening behaviours. Haack (1992) believes

the fact that music increasingly permeates and at times even seems to dominate our environment and our society, points with growing importance to not just the nicety, but the necessity of music listening education – and the concomitant need to expand the research base that supports this essential aspect of contemporary music education. (p. 463)

Such research-based knowledge is necessary to help music educators develop strategies that promote active and attentive music listening, so their students will derive an appropriate depth of musical understanding from their extensive daily exposure to recorded music.

The current exponential growth in computer-mediated communication has added yet another substantial layer of complexity to the ways in which people listen to music. The ubiquitous presence of electronic technology in contemporary society has been aptly characterised by Birkerts (1994) who observes that "in less than half a century we have moved from a condition of essential isolation into one of intense and almost unbroken mediation. A finely filamented electronic scrim has slipped between ourselves and the so-called outside world " (p. 5). To an increasing extent, music is being encountered as a component of complex multimedia computer presentations in which recorded music is frequently interpolated with an array of detailed visual information. For example, digital audio recordings of works such Mozart's *The Magic Flute* and Stravinsky's *The Rite of Spring* have been used as foundations for the development of interactive multimedia music instruction (IMMI) programs. These IMMI programs usually provide a comprehensive musicological analysis of a composition that situates the work within its cultural and social context. Computer-delivered IMMI employs graphics, moving images, narration, music notation, and pre-recorded music examples to present a database of
related information with which users interact, typically by clicking and selecting on-screen objects with a mouse.

IMMI resources are increasingly being adopted as a means of supplementing, and at times replacing, traditional face-to-face music instruction (Higgins: 1992, Berz and Bowman: 1994, Stevens: 1994, Berz: 1995, Neuenfeldt: 1997). Software development companies such as Microsoft and Voyager have published a wide range of IMMI programs since the 1989 release of the first such program on Compact Disc Read Only Memory (CD-ROM). In a recent survey of the interactive multimedia music resources available for use in British schools, Bray (1997) identified approximately one hundred and fifty music titles. In addition to commercial software, many educators are now beginning to develop their own IMMI programs and there is increasing use of recorded music in interactive multimedia presentations across computer networks such as the Internet (Hayward: 1995, Hayward and Orrock: 1995, Czencz and Hayward: 1997, Neuenfeldt: 1997, Patterson and Melcher: 1998).

The perceived benefits of the use of interactive multimedia in music instruction have been identified by Parakilas (1996) who points out that "as a reference tool for learning about music, CD-ROM [interactive multimedia music instruction] is really distinguished by its capacity to connect words and images to musical sound. For the first time, we have entries on music that we can listen to as we read" (p. 1). The opportunity to listen and read may be one of the most important advantages of interactive multimedia when it is used in music instruction (Kemp: 1986, Renwick and Walker: 1992, Stevens: 1994, Berz: 1995, Rudolph: 1996). In comparison to traditional text-based learning tools, interactive multimedia resources provide what Winter (1989) describes as

... the ability to relate live musical passages and ideas about those passages instantaneously to one another. Not only can you read about the material which Beethoven used to compose a particular passage, but with
the click of the mouse you can command the Vienna Philharmonic to play this precise passage for you. (in author’s Preface)

IMMI programs provide unparalleled access to high quality music recordings and a wide array of related information in one convenient package that offers substantial educational potential. However, as Abeles et al. (1984) have previously cautioned, the easy availability of recorded music may provide many benefits, but this accessibility does not necessarily result in an increase in thoughtful listening or deeper musical awareness. Observers such as Reeves (1992) have warned there is a tendency towards uncritical optimism about the use of interactive multimedia in instructional settings which frequently leads to the erroneous perception that interactive multimedia "automatically guarantees learning" (p. 48). While the casual exploration associated with repeated exposure to recorded music in IMMI settings may encourage, as Elliott (1995: 94) suggests, a "novice level of listenership (music-listening know-how)", the development of musical understanding depends to a large extent on the quality of the listening experience, which in turn is contingent upon the level of the participant's cognitive interaction with the musical stimuli (Meyer: 1994). Desensitisation, as a result of overexposure to recorded music in its many forms, may encourage the formation of inattentive listening habits that constrain participant interaction with IMMI music examples and inhibit music learning.

The Need for the Study
The underlying impetus for the present study rests in contemporary theories of music education which suggest that effective music instruction depends to a substantial degree upon an active and attentive approach to music listening (Kemp: 1986, Serafine: 1988, Gordon: 1989, Meyer: 1994). While an awareness of musical concepts may develop as a result of learner interaction with the visual components of computerised music instruction, deeper musical understanding is built upon attentive music listening. In the
IMMI setting, music listening is contingent upon participant interaction with music examples and thus the manner in which users interact with sound during IMMI sessions may have a profound influence on their capacity to transform interactive multimedia experience into musical understanding. Burkman (1987), however, has observed that users often do not react to computerised instruction programs in the way in which the author intended, and Ferry, Hedberg, and Harper (1996) report that the inappropriate implementation of computerised instruction, as a result of unexpected participant interactions, is likely to limit its educational effectiveness. In a survey of learning in interactive multimedia systems, Nelson and Palumbo (1992) point out that "since learners each have unique knowledge structures based on their experiences and abilities, the ways that they choose to access, interact, and interrelate information in the knowledge base will also vary" (p. 288). Higgins (1992) confirms this view and maintains that as learners each have an individual approach to instruction, it is important to identify the essential variables of technology-based instruction and the types of interactions that learners have with those variables. However, most of the research to date rests on the assumption that it is the technology itself which influences instructional outcomes. Studies have tended to focus on the feasibility and effectiveness of instructional technologies by comparing mediated instruction with traditional teaching methods, rather than examining the interactions that occur between users and the components of mediated instruction which may have, as Higgins cautions, "an effect on the instructional environment to such a degree as to be a dependent variable" (p. 492).

Hence, there is a need for research to focus not only on comparisons between mediated instruction and traditional teaching methods, but on the analysis of individual participant interactions with the components of mediated instruction (such as sound) and the effects that such interactions may have on individual instructional outcomes. While anecdotal evidence by observers such as Rudolph (1996) suggests that IMMI participants are "more involved and interested and will listen longer to an entire movement or classical
work" (p. 85), the empirical investigation of user interactions with the media components of IMMI remains limited, and current understanding of how participants interact with sound in computerised music instruction is poor.

A review of the limited research relating to sound use in IMMI reveals several early studies which assess the feasibility and comparative effectiveness of interactive multimedia in music instruction (Lee: 1989, Hughes: 1991, Sigurjonsson: 1991, Goodson: 1992, Duitman: 1993). While these studies confirm that interactive multimedia music listening tools can produce student achievement on music listening tests equal to or higher than traditional instructional methods, often in less instructional time, they do not address the important issue of IMMI participants’ interactions with music examples. These early investigations do, however, point to the instructional importance of participant interactions with the individual media elements of IMMI. Hughes (1991), for example, recommends further scrutiny of IMMI participants’ music listening behaviours and in particular the amount of time IMMI participants spend listening to music. Duitman (1993) likewise calls for research to determine how much time CD-ROM participants spend listening to music only, and how much time they spend listening to music while engaged with the visual elements of IMMI programs.

Observations by Berz and Bowman (1994) suggest that in most commercial IMMI programs, participants are encouraged to read information on computer screens while music is playing. However, the simultaneous presentation of information in multiple sensory modes can lead to disruptions in concentration and to memory loss (Travers: 1964, Robinson: 1985, Salame and Baddeley: 1989, Gavora and Hannafin: 1995, Shih and Allesi: 1996). The available evidence indicates that IMMI participants might not be able to pay adequate attention to both the music examples and the visual stimuli that accompany them. In the presence of multiple stimuli, limitations in human information processing capabilities, and perhaps a habit of not listening carefully to musical stimuli,
may influence IMMI users to shift their attention away from music listening or to curtail their music listening altogether. A recent study of participant navigation in IMMI documents by Berz (1995) found a high level of individualistic navigational behaviour and a pronounced tendency for participants to interrupt the playback of music examples. Berz concludes that "students were seemingly not interested in the aesthetic or structural properties of the musical performance, which would require a complete hearing, but were interested in the primary objective of identification of orchestral instrument by sight and sound" (p. 181). While he surmises that the observed interruptions could be explained in part by the restricted instructional objective of his study and the relatively limited length of the music examples, the high incidence of interruption to music examples was nonetheless "surprising" and "somewhat alarming" when considered in relation to the aesthetic aspects of musical experience. Berz wonders "at what point the musical knowledge-base becomes invalid through interrupted hearings?" (p. 181). While students might be expected to curtail their music listening to allow for "study, reflection, and/or repeated hearings... if the musical work is not ever heard in its entirety, can it be fully understood and aesthetically perceived" (p. 181). The interruption of musical flow in IMMI is a critical research issue requiring further investigation which focuses on participant interactions within IMMI programs that employ intact music examples in the context of broader instructional objectives.

Studies of the function of computer-delivered sound in non-music domains also suggest a pressing need for further research (Jasper: 1991, Blattner and Greenberg: 1992, Barron and Kysilka: 1993, Blattner: 1993, Barron and Atkins: 1994, Daniels: 1995). In a survey of the role of sound in computerised instruction, Aarntzen (1993) presents the consensus view that while a considerable amount of research attention has focused on the visual aspects of computerised instruction, almost nothing is known about its auditive aspects. The lack of research interest has arisen largely as a result of visual dominance in the development of computer hardware and the relatively limited sound reproduction
capabilities of most early computers. In spite of substantial improvements in computer-delivered sound since the introduction of random-access digital audio in the early 1980s, research into the role of sound in computerised instruction remains limited. Moreover, benchmark texts by Kearsley (1986), Hannafin and Peck (1988), Jonassen (1988b), and Alessi and Trollip (1991), which provide detailed guidance for the development of computerised instruction, offer almost no advice about sound design. Critics such as Mann (1995) have noted that in the absence of research-based guidelines, there has been an "intuitive" approach to the use of sound in computerised instruction. An intuitive approach to software design and the implementation of sound in IMMI is unlikely to provide the most educationally productive solutions.

The integral importance of software design in the effective development of interactive multimedia is acknowledged by Park and Hannafin (1993) who argue that research-based design guidelines are essential if the educational potential of interactive multimedia is to be realised fully. Software design is critical as it establishes the structural framework of a computer program and determines the nature of access to the information that the program contains. Interactive multimedia designers can allow users considerable freedom to influence the instructional pathway as they navigate through a program (Schwier and Misanchuck: 1993). Users can also be given a high degree of control over individual media elements such as sound. However, while Berz and Bowman (1994) have reported that flexibility is seen as one of the principal benefits of interactive multimedia, it comes at some cost. The disorientation that can occur in interactive multimedia programs is a widely reported problem (Conklin: 1987, Marchionini: 1988, Gygi: 1990, Trip and Roby: 1990). As Schwier (1995) points out, allowing learners such a high level of instructional flexibility permits them to make "poor decisions about which content is important and how much practice is required, which in turn may be reflected in decremented performance" (p. 121). Likewise, Jonassen (1988a) warns that the less structured the interactive multimedia experience is, "the less likely users are to integrate
what they have learned" (p. 14), while Plowman (1994) reports that "the experience of using interactive multimedia programs can be extremely fragmented" (p. 278).

The high degree of instructional freedom often provided by IMMI means that the level of user interaction with mediated instructional content may vary considerably depending upon the complex interaction of variables such as program design and the individual characteristics of the participants such as domain knowledge, motivation, problem solving skills, and their level of prior computing experience (Fleming: 1987, Higgins: 1992, Reeves: 1992, Berz and Bowman: 1994, Recker: 1997). For example, research by Cates (1991), Lucas (1992), and Nelson and Palumbo (1992) indicates that novices in a particular knowledge domain are less efficient in selecting appropriate instructional pathways and may need a more guided approach to instruction.

Thus, while some IMMI users may engage in an appropriate level of music listening, a low level of listening interaction with music examples may compromise the music learning of other participants. The aforementioned research by Berz (1995) indicates that IMMI participants rarely listen to entire music excerpts. Such widespread participant interruption of IMMI music examples suggests a lack of the attentive and sustained music listening behaviours that many music educators believe are critical in the development of deeper musical understanding. If listening is a key element in music learning, how can music educators ensure that participants interact with the musical content of IMMI programs in appropriate ways? While so little is known about how users interact with sound in computerised music instruction it is questionable whether the full instructional potential of IMMI can be realised. Without research-based understanding of how students interact with music examples in IMMI, music educators may be unable to integrate IMMI into their instructional strategies in ways that support active aural participation and an attentive approach to music listening.

**Purpose of the Study and Statement of Research Questions**
Given the pivotal importance of listening in music instruction and rapid escalation in use of IMMI resources in music education, there is a pressing need to address the lack of understanding about how IMMI participants interact with sound. This study takes an exploratory step toward providing the fundamental knowledge about IMMI participants’ music listening behaviours which music educators and IMMI software designers urgently require. With the aim of improving the educational effectiveness of IMMI, the overall objective of this study is to document and explain IMMI participants’ interactions with the music examples that are made available during IMMI sessions. Specifically, the investigation uses digital audio technology to record, analyse, and report on the extent of participant interaction with the audio components of two IMMI programs, namely, *Mozart Dissonant Quartet* (1991) and *Microsoft Musical Instruments* (1993). A particular objective is to characterise participants’ interactions with IMMI audio components through the use of graphic-based Sound Activity Profiles (SAPs) which have been developed by the author for use in the current study. Further research attention is focused on the level of participant activation and interruption of IMMI music examples. A supplementary goal is to assess the accuracy of participants' perceptions of IMMI session sound activity by comparing subjects’ perceptions of their session sound usage with objective measures of session sound activity. Finally, in an attempt to ascertain the extent of the influence of prior computing experience on IMMI participants’ sound activity, the relationship between participants' previous computing experience and the level of their interaction with IMMI music examples is investigated.

The study focuses on the IMMI session sound activity of a group of undergraduate (Bachelor of Music Education) music students. Specific attention is given to an assessment of the participants’ use of three audio components that commonly occur during IMMI sessions, namely, *Music, Voice, and Silence*. In this study, the term *Music* refers to pre-recorded music examples that are present in the two IMMI programs used in the investigation. *Voice* refers to the pre-recorded narration of text and
any other recorded speech that is accessible in the selected IMMI programs. *Silence* refers to the periods of time during the IMMI sessions when there is no computer-delivered sound.

The investigation aims to answer the following questions:

1. What percentage of total session time does each of Music, Voice, and Silence occupy when participants engage in a twenty minute session with each of the selected IMMI programs?

2. What is the frequency of occurrence and mean duration of discrete Music, Voice, and Silence Events when participants engage in a twenty minute session with each of the selected IMMI programs?

3. How frequently do participants interrupt the playback of Music examples during a twenty minute session with each of the selected IMMI programs?

4. How do participants' perceptions of IMMI session sound activity compare with objectively verified measures of their session sound use?

5. What degree of association exists between participants' prior computing experience and the extent of participant interaction with Music, Voice, and Silence during twenty minute sessions with each of the selected IMMI programs?

An initial phase of the study focuses on collecting quantitative data relating to the first three research questions. Following preliminary analysis of that data, a second phase of data collection and analysis is undertaken where qualitative procedures are employed in an attempt to characterise and explain participant music listening behaviours that became
evident during the first phase of the study. The need for "follow-up" data and the procedures employed in its collection are discussed in Chapter Three.

In attempting to answer the research questions, the study makes use of a novel investigative procedure that extends the application of digital audio recording technology to the analysis of music listening behaviours. The aim of the analysis, which is described in Chapter Three, is to produce an objective assessment of the extent and character of participant interactions with IMMI audio components. Essential to the interpretation and practical implementation of the results of the investigation is an assumption that the extent of participant interaction with IMMI music examples is a reliable indicator of the level of the participants’ active cognitive engagement with IMMI music examples. Related research by Cotter and Spradlin (1971) and Dorow (1977) supports the view that objective measures of music listening time are a fairly stable and a reliable behavioural measure of attention to music. Nonetheless, it is important to emphasise that while a high level of participant interaction with IMMI music examples does not ensure attentive music listening will occur, as other variables are likely to intervene, it is axiomatic that a low level of participant interaction with IMMI music examples will constrain attentive music listening. Hence, participants of this study who exhibit a low level of interaction with IMMI music examples, are assumed also to have demonstrated a low level of attention to music listening.

Limitations of the Study
The following issues are acknowledged and have been considered in the design of the study and in the interpretation of its results.

1. This exploratory study employs a sample of volunteers drawn from a population of Bachelor of Music Education students. The limitations of research involving volunteers that have been identified by Gall, Borg, and Gall (1996) are
acknowledged and have been taken into account in the consideration of the results of the investigation.

2. The sample size and the duration of the study sessions were limited by the availability of resources. Such restrictions mean that further research is needed to consolidate the current findings.

3. The study focuses on the use of IMMI in a university music education setting. Participants in other settings may react differently and generalisation of the study findings to other groups needs to be undertaken with caution.

4. The investigation does not aim to assess music learning in IMMI directly, but focuses on behavioural aspects of user interactions with IMMI audio components.

5. The results of the investigation relate to design characteristics of the IMMI programs chosen for use in the study. While every attempt was made to select programs that were representative of the range of commercial IMMI resources in widespread use at the outset of the investigation, rapid technological evolution means that novel strategies are likely to have emerged in the design and implementation of IMMI programs before the current investigation has been completed. Nonetheless, it is anticipated that the essential concern of this investigation of IMMI participants' audio interactions will remain relevant.

As previous research into participant interactions with IMMI audio components is limited, an examination of related literature follows in Chapter Two. The study research methods are described in Chapter Three, and the results of the investigation are presented in Chapter Four. Finally, Chapter Five contains a discussion of the findings and their implications, in which recommendations for further research are provided.