THE EFFICACY OF CONCEPT MAPPING IN AURAL SKILLS TRAINING

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It was the purpose of this study to explore if there is a more effective way to practice aural skills, one that could be individualized as well as computer based: a method of practice that would enhance what the instructor does in the classroom and help the student reinforce their recognition of the basic elements of aural skills and dictation. Concept mapping, which has been beneficial in other educational settings, especially math and science, might be such a way. The goal of this study was to examine if this procedure could be applied to aural stimuli in the same way it has been applied to verbal information.

Sixty-four students in a first year college aural skills class were randomly assigned to two groups. Following a pretest of twenty-five chords randomly chosen from a pool of fifty, one group was presented with a lesson on concept mapping while listening to the chords and the other group received a distractor task. The results of these tests showed a higher gain score for the treatment group, $M = 5.33$, than for the control group, $M = 1.25$. An Analysis of Covariance (ANCOVA), showed a moderately significant gain of $p = .030$ (one-tailed) for the treatment group. Overall, the test results indicated a positive effect of the treatment on the ability of the participants to recognize chords in the posttest. Due to the limitations in the present study, more research is suggested to determine the effectiveness of the process.

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PREFACE

This paper is dedicated to the memory of Dominic Intili, a colleague, friend and mentor. Dr. Intili helped me to think critically and guided my initial research in the area that has culminated in this study. It was his suggestion that got me started on this endeavor and his encouragement that kept me going. I am also grateful for the guidance and patience of my advisor, Dr. Louis Berry, who didn't give up on me. My special thanks go to the members of my committee for their comments and insights that have helped me prepare this document and especially to Dr. Donald McBurney who went beyond his duty to offer much valuable guidance and advice. I also express appreciation to my friend Dr. Andrew Kohn for reading and critiquing the document. His comments helped make it more coherent, understandable, and grammatically correct. Last, but not at all least, I am thankful for the patience and constant encouragement of my wife Lucy and daughter Lara. Without them, and God's help, this would never have been completed.

1. INTRODUCTION

One of the fundamental areas in a musician's training is Aural Skills. Aural Skills, which encompasses both sight-singing and ear-training, is concerned with musical sounds and the analysis and understanding of these sounds by ear. It is the ability to look at musical notation and be able to imagine (audiate) the sound of the notes as well as the ability to hear musical sounds and be able to put them into musical notation. The New Harvard Dictionary of Music (NHDM), defines ear training as: "training intended to improve musical perception, including the ability to recognize by ear alone and reproduce in musical notation, melodies, intervals, harmonies, rhythms, and meters and the ability to sing at sight. Practice in the former is often termed dictation; in the latter, sight-singing" (Randel, 1986, p. 248). Bruce Benward, the author of several standard textbooks for aural skills, calls this the "seeing ear" and the "hearing eye" (Benward, 2000). These sounds are the basic elements of music: the interval between two notes, the combination of several notes sounding together to make chords, and the rhythmic relationship of these notes. These are the elements traditionally used to create a musical composition.

1.1. BACKGROUND OF PROBLEM

Aural Skills training receives a variety of instructional strategies, the most common of which is a classroom setting with 15-20 students. Activities include practice singing exercises (sight-singing) and notating materials played by the instructor (dictation). Included in the dictation component is the identification of intervals in a melodic context (two notes played one after the other) and in a harmonic context (two notes played simultaneously) as well as the identification of chords (three or more notes played simultaneously). In a group of this size, backgrounds and abilities can vary widely. Some students are able to perform a task easily while others have more difficulty. In this setting it is difficult for the instructor to be effective with every student. It would be better to give individual instruction to each student according to his or her particular needs, background, and ability. Unfortunately that is not feasible in academic environments that mandate more students per instructor to cover the rising costs of education. Furthermore, this training requires specialized equipment such as a piano and audio systems to present the material to the students. When viewed in this light, aural skills instruction, as presently given, is both expensive and inefficient.

It is the experience of this writer over twenty years of teaching, and in dialogue with other teachers, that individualization is important if not absolutely necessary. Many have been frustrated by the diverse nature of student's ability to perform these tasks and the lack of classroom time to adequately work with each student. Furthermore, practice materials were designed for a general audience and were not easily individualized for the specific needs of a particular student. Computer Aided Instruction (CAI) and the development of the personal computer, especially the introduction of the Apple II in the early 1980's, spawned much activity in aural skills training. It was now possible to present sounds as well as verbal and graphic information and to interact with each student individually. The student could take as much or as little time as desired to achieve the task and it was possible to provide remediation and feedback on the student's progress. This technology has made significant advances since the Apple II computer. High quality sound and graphics are now possible and the computer can present aural information in a variety of combinations not otherwise available to the classroom instructor. For example, present personal computers, using built-in sound cards or software sound synthesis, can play musical examples using a wide array of instruments not possible on a piano (with the exception of an electronic piano with sampled or synthesized sounds).

Although the technology has improved greatly, the educational quality of aural skills instruction has changed very little (Karpinski, 2000). Current materials are, for the most part, drill and practice programs that are not much more than "high tech" flashcards with sound. It is not surprising then, that studies of the effectiveness of CAI in aural skills training have shown mixed results (Fletcher-Flinn & Gravatt, 1995; Ozeas, 1991). In recent years there has been a shift from the Skinnerian, outcome based, behaviorist view of education to a constructivist model: that is, a model that engages learners in constructing their own knowledge base (Cooper, 1993). Even though there has been much research studying cognitive processes with a resulting improvement in the delivery of information, little has been done using technology to help the learner process that information in a way that is useful to future learning (Higgins, 1992; Jonassen & Reeves, 1996).

Is it possible that our traditional approach to aural skills training does not adapt well to computer based instruction? Is it also possible that we are interfering with the process of recognizing pitch patterns by imposing the wrong type of analysis? Perhaps a new model is needed that does more than merely drill the user and instead employs the computer to actively involve the user in the learning process.

Traditional models of education are centered on the teacher who presents material to the student. The student receives this material and, in a good classroom, interacts with it in order to learn what the teacher has presented. Learning is then assessed by a test of some sort that demonstrates the student's mastery of the information. This model merely presents information for the student to process and absorb. In the constructivist model, "learning is an active process of constructing rather than acquiring knowledge" (Duffy & Cunningham, 1996). That is, learning is the activity of constructing knowledge based on each individual's understanding of the material in context with the desired outcome, and not merely a reproduction of someone else's knowledge (Jonassen & Reeves, 1996). This process involves a higher order of thinking skills than do simple drills and should therefore, result in more complete understanding (Gagne, Briggs, & Wager, 1992).

There are a number of techniques that can be employed to achieve this level of critical thinking. Jonassen (Jonassen, Peck, & Wilson, 1999) calls these "Mindtools." Mindtools are activities that involve the learner in an active process that applies the new information to the learner's previous knowledge in ways that are meaningful to the learner. Among these are "databases, spreadsheets, semantic networks, expert systems, multimedia construction tools, microworlds, dynamic system modeling tools, visualization tools, and computer conferencing" (Jonassen et al., 1999). For example, students in one school produced a database comparing the social and economic development of different countries (Jonassen & Reeves, 1996). In the process they learned about such concepts as gross national product, population and personal income. In another case, students created a semantic network of concepts and attributes of the Tyrannosaurus (Jonassen et al., 1999). The outcome was a visual chart showing how each of these attributes was related to the Tyrannosaurus. In each case, the students constructed a knowledge base themselves. In so doing they made understanding the subject, whether it was anthropology or archeology, more meaningful to them than from just listening to a lecture or reading a book. The learning was the result of active involvement with the material by the student as opposed to passive reception of information.

The technique from the above list that could be most useful to the goal of finding a more efficient and meaningful way of reinforcing aural skills might be that of semantic networks, also known as Concept Mapping. Concept Mapping (CM) is a visualization tool that is believed to be analogous to how cognitive structures are built. Most researchers agree that for an item to be remembered, it must be attached to previous knowledge. Concept maps, are a type of graph that the learner constructs to link one concept or idea with others using nodes and arrows showing how theses are related. For example, the concepts of "blue" and "sky" can be linked to make a new proposition that the "sky is blue" (Novak & Gowin, 1984). McCann (1997) defines semantic networks as "knowledge representation schemes involving nodes and links (arcs or arrows) between nodes. The nodes represent objects or concepts and the links represent relations between nodes. The links are directed and labeled; thus, a semantic network is a directed graph. In print, the nodes are usually represented by circles or boxes and the links are drawn as arrows between the circles as in Figure 1 (McCann, 1997). This represents the simplest form of a semantic network, a collection of undifferentiated objects and arrows. The structure of the network defines its meaning. The meanings are merely which node has a pointer to which other node. The network defines a set of binary relations on a set of nodes."

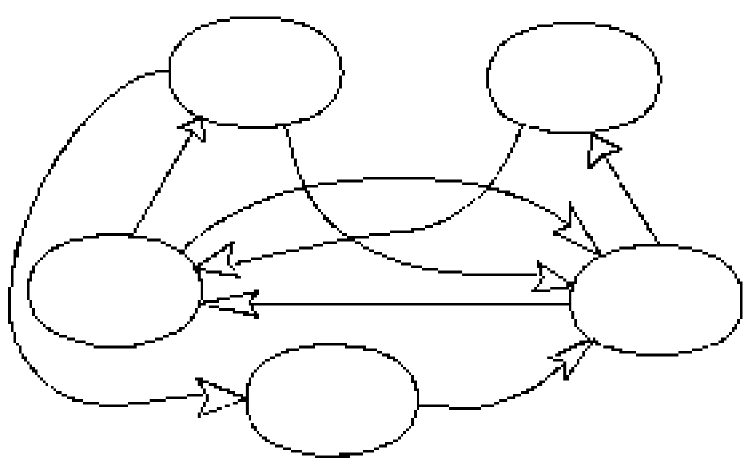


Figure 1 – Semantic network example

Developed by Joseph D. Novak at Cornell University in the 1960's, CM was based on the theories of David Ausubel (1963) who stressed the importance of prior knowledge in being able to learn new concepts (Plotnick, 1997). Novak concluded that ″meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures″ (Novak, 1993). Concept mapping has been used in a variety of applications from elementary school students to researchers in higher education as well as in business and marketing applications. Concept maps can be used to "brainstorm" ideas, outline research, or make associations with other material. They can be constructed new for each item or embedded in an existing program (Barba, 1993). Furthermore, concept maps can be used with many different types of material.

Below are two examples of concept maps using diverse subject matter. In the first (Figure 2), the main idea of Congress is at the head with facts about Congress below. Arrows flow from the main idea to the elements of Congress and facts about each house and their purpose. Other links are made between these nodes to show the relationship between the two houses of Congress.

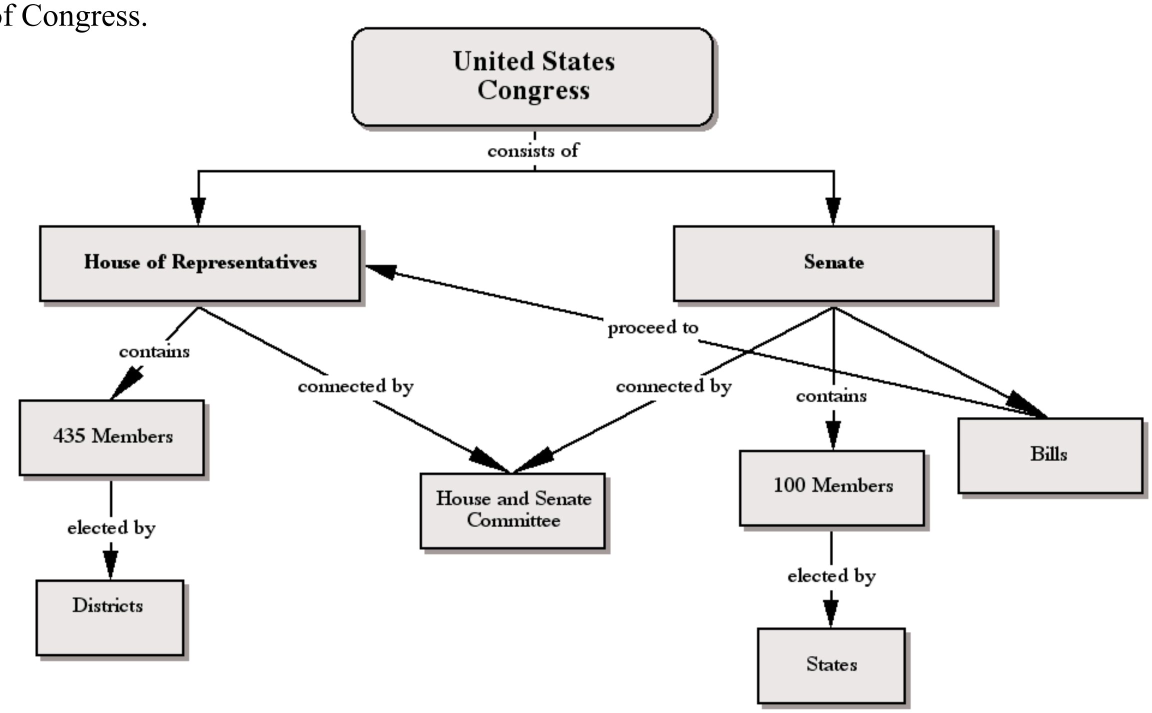


Figure 2 - Concept Map Example

The second example (Figure 3) uses pictures as a way of using familiar concepts to help describe the main concept.

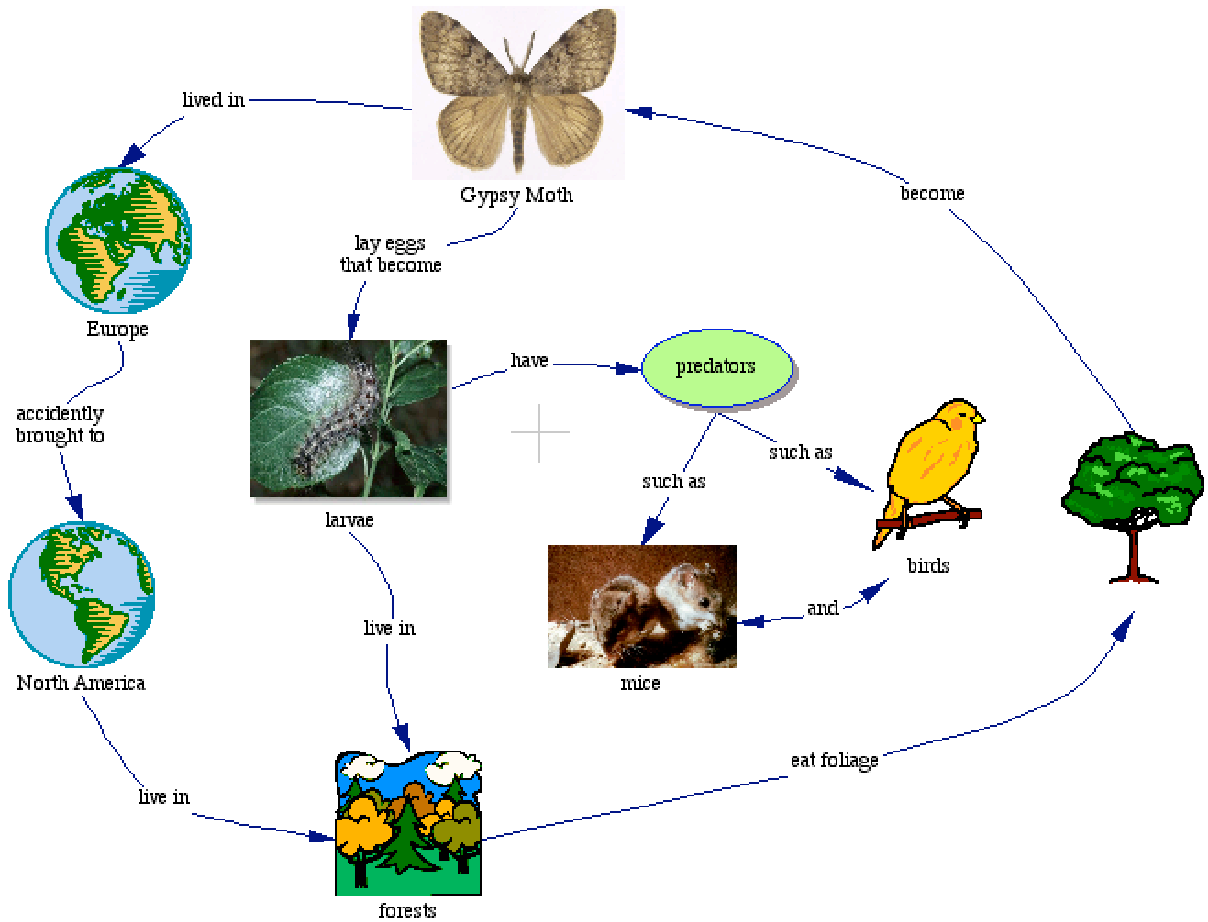


Figure 3 - Concept Map Example with icons

Training musicians in the interrelated disciplines of aural skills and music theory should incorporate our knowledge of the cognitive process. It is generally held that there are three stages in the cognitive process: sensory memory, working memory, and long-term memory (Craik & Lockhart, 1972). The sensory memory is our first step, the manner by which we receive information. If information is to be effective, it must first be registered perceptually. That is to say, a person must see, hear, feel, or otherwise sense the information. The two major characteristics of this memory are high capacity and fast decay (Bourne, Dominowski, & Loftus, 1979). For the musician, the primary importance of this step in the cognitive process seems obvious since music is perceived through our sense of hearing. However, there is an even more important aspect of this level of memory that has direct application to aural skill development in music: the process of pattern recognition is initiated during sensory storage. Although the entirety of information stored in sensory memory is itself unorganized and therefore ultimately meaningless, the persistence of images in this mode allows the process of identification and recognition to begin. In order for an image to be recognized it must be understood in light of previous experience (Bourne et al.).

In music, research in aural skills training has shown that context is also important in making meaningful connections with musical stimuli (Cuddy & Upitis, 1992). This fact is hardly new, nor has it gone unnoticed. The noted Hungarian composer and educator, Zoltan Kodaly, utilized Hungarian folk melodies as the basis for his music education system (Chosky, 1974). These melodies were familiar to the students and were used to reinforce the development of sight-singing and dictation. Indeed, one of the earliest recorded music education methods, Solfege, was based on a well known hymn, *The Ode to St. John the Divine* (*New Grove*, 2002). A Benedictine monk, Guido d'Arezzo, used the words (syllables) that started each phrase of the music—each of which was a step higher than the previous—as a way to help the choir remember the degrees of the scale. He employed both context and previous experience as the basis for a system that has endured for centuries.

Since the goal of aural skills training is to recognize musical material and then to either write that material in notation (dictation) or to sing (sight-singing) the passage, the process of linking something familiar with the new material is very important. The methods described above have been used in the classroom to help the student recognize and remember aural information, but individual practice methods do little more than simply present the material with little or no guidance for being actively involved with the material in order to remember and use it in a meaningful way. Concept mapping (as shown above) has enhanced memory and learning in other disciplines. Can this technique also be used in music?

1.2. PURPOSE OF STUDY

Recent research has documented the use of active learning processes in music education (Foulkes-Levy, 1996) but there is little evidence of this in Computer Assisted Instruction (CAI). Students have benefited from research in active learning in the classroom, especially in the area of sight-singing. However, dictation and especially practice exercises in dictation have not changed significantly in the past 50 years (Hedges, 1999).

It is the purpose of this study to explore if there is a more effective way to practice aural skills, one that can be individualized as well as computer based: a method of practice that would enhance what the instructor does in the classroom and help the student reinforce their recognition of the basic elements of aural skills and dictation. Concept mapping, which has been beneficial in many other educational settings (Milam, Santo, & Heaton, 2000), might be such a way. The goal of this study is to examine if this procedure can be applied to aural stimuli as it has been to verbal information.

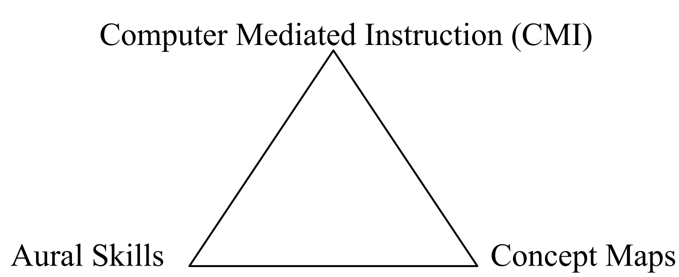
Although the most common use of Concept Maps or Semantic Networks is to provide a graphic representation of concepts and their interconnection (Novak, 1984), the process of linking ideas or descriptions to a central idea could conceivably be applied to abstract ideas as well (Hyerle, 1995). If it is shown that the CM process applied to aural stimuli can be used to enhance learning in Aural Skill (dictation) training, then it could be used as the basis for curriculum design that would address the problem of providing individual instruction using computer technology that results in more effective understanding of the aural elements of music than results from current CAI. Given the capability of the computer to provide quality sounds and graphics, and given the need for individualized instruction without using more of the instructor's time, such a curriculum would especially benefit programs where budgets are tight. This curriculum would allow a single instructor the capability to work more effectively with more students however, no computer-based instruction should be used exclusively in place of an instructor, but rather to help the instructor.

1.3. RESEARCH QUESTIONS

This study will explore the following questions:

1. Can the process of Concept Mapping be applied to aural stimuli?
2. Does the process of Concept Mapping of musical elements such as chords improve the recognition of those elements in random test of chord qualities?
3. Can this process be mediated via a personal computer?

These three basic questions form each leg of a triangle that will aid in creating an effective and efficient curriculum design.



Although there are three elements, the overall goal of this study is not to study the elements individually, but as a whole. Therefore, the primary research question for this study was:

> Can the construction of a Concept Map while listening to chords improve recognition of these chords as shown by a statistically significant difference between a pretest and posttest of randomly selected chords?

If a significant difference can be found, then it can be concluded that Concept Mapping can be applied to aural stimuli in the same way it is used in other disciplines to create a deeper understanding of the subject. Furthermore, because the information is being mediated via the WWW and a personal computer, a statistically significant difference would indicate that this form of mediation was possible. If no significant difference is found, then other studies will be needed to determine if CM can be applied to aural stimuli and to determine if web mediation had any influence on the outcome.

Because concept maps are a good way of explaining relationships visually, below (Figure 4) is a concept map describing the relationships in this study.

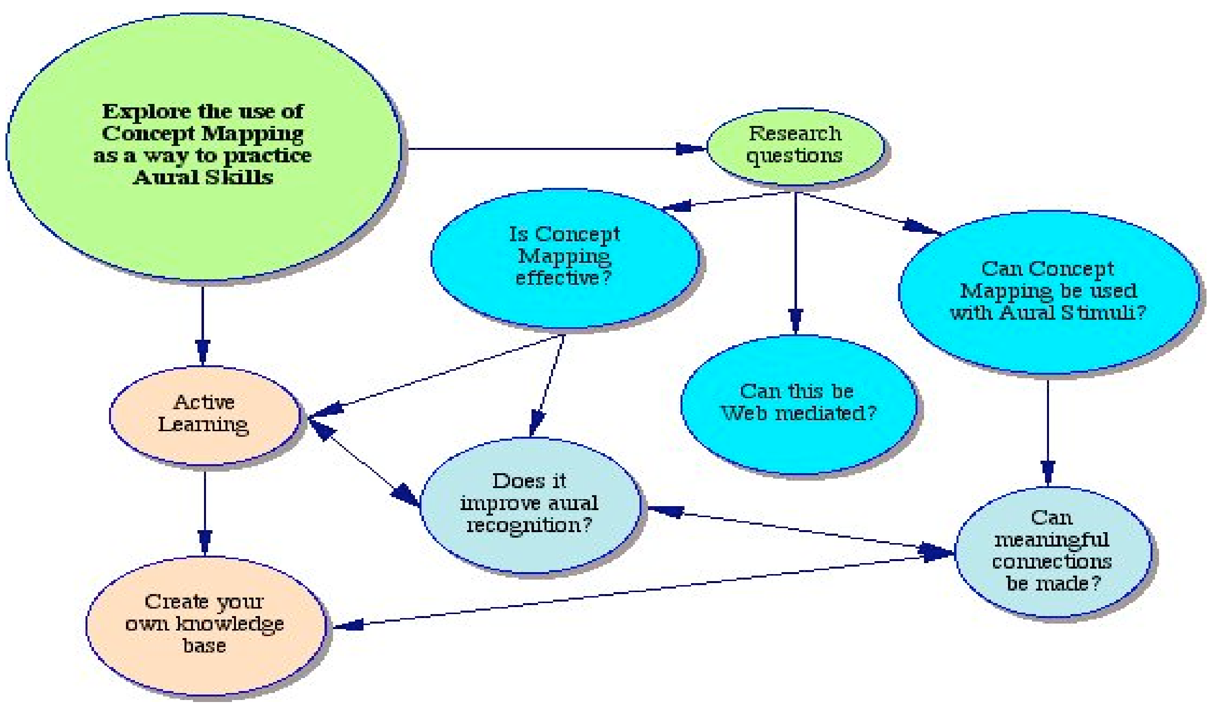


Figure 4 - Concept Map of Study

As shown above CM, as an active process, is an effective learning device (Jonassen, 1991). For this study, aural information will be given to which the associations will be made. While it seems logical that aural information can be used the same way as written verbal information, this study will determine if this is indeed possible. Will the learner be able to make associations with aural information and will those associations be meaningful to the learner? If such connections can be made, then do these associations—actively prepared by the learner—result in enhanced recognition of the aural information when presented in another context? Furthermore, can this all be mediated by a computer via the web? If so, further studies should be done to design an aural skills curriculum that employs these techniques.

1.4. SCOPE AND LIMITATIONS OF STUDY

In aural skills training, there are a number of factors that are combined to achieve the overall goal of developing highly discriminatory listening skills. Among those factors are pitch, rhythm, tonality, and harmony. There has been much discussion on the relationship of these factors and how they should be taught (Karpinski, 1990); however, it is not the purpose of this study to get involved in these. In order to minimize other factors this study will only assess the identification of chord types (major, minor, diminished, and augmented), including inversions and dominant seventh chords. Analysis and identification are important components of aural skills training (Pratt, Henson, & Cargill, 1998) and one that is central to the other skills. All chords will be a sampled piano sound and use notes between C3 – G5 (C4 = middle C). It is not the goal of this study to compare this process with the traditional methods of drill and practice found so commonly in aural skills software. The goal is only to determine if the principles of CM can be applied to music. If so, then other studies can be done to compare this method with other more traditional methods.

Another goal of this study is to present this material via the computer. Personal computers are now commonplace, easily accessible, and have the capability of presenting music material in a high quality form. They also have the capability of presenting graphic information as well as allowing the user to prepare boxes and text and to make connections to these on the screen. For this study, however, the participants will complete basic concept maps using pencil and paper while listening to the sounds on the computer. The primary function of the computer is to present (mediate) the material to the user, thereby allowing the user to interact with this information. The purpose of the CM process is to promote active involvement with the stimulus.

1.5. DEFINITION OF TERMS

Aural Skills. The development of the ability to "see what is heard" and "hear what is seen." (Benward, 2000)

The basic components of aural skills are:

Intervals. The relationship between two pitches.

Chords. Three or more pitches sounded simultaneously.

Inversion. Chords containing the same notes, but with different note factors in the bass.

Seventh chords. Chords that include the interval of a seventh from the root (NDHM, 1986).

Computer Aided Instruction (CAI). Also known as Computer Assisted Instruction. Instruction given on a computer to aid or assist the classroom instruction.

Computer Mediated Instruction (CMI). Instruction that is presented primarily by a personal computer.

Concept Mapping (CM). Also known as Cognitive Mapping or Semantic Networks.

A graphic notation for representing knowledge in patterns of interconnected nodes and arcs. (Sowa, 2002)

HTML. Hypertext Markup Language, the primary computer language for presenting information via the internet.

NHDM. New Harvard Dictionary of Music

Web-based Instruction (WBI). Instruction delivered via the World Wide Web (WWW).

WebCT. An on-line learning environment developed by WebCT, Inc.

2. REVIEW OF LITERATURE

2.1. INTRODUCTION

It is generally agreed among music educators that aural skills training is fundamental to the musician's development and is the cornerstone of music learning (Schmidt, 1984; Sidnell, 1973). A primary goal of aural skills training is "to develop in students the ability to recognize and understand musical relationships with the minds's ear" (Klonoski, 1998, p. 81). According to Karpinski (2000), "Learning to hear and read music with understanding and facility is arguably the most important goal we set for our students (p. 7). Indeed, aural skills training has been a central part of musician's training ever since Guido d'Arezzo first developed his method of sight-singing (Karpinski, 2000). Although this training has been with us a long time, educators are increasingly questioning the effectiveness of the old "tried and true" methods.

Pembrook and Riggins (1990) write "The two most critical issues in teaching are methods and materials" (p. 231). Their survey revealed that the majority of college and university music departments used the same or similar materials and techniques. Marvin (1995), however, suggested that music theorists should be reading psychology journals in order to apply what has been learned in the fields of psychology and cognitive science to music education. In their book *Aural Awareness: Principles and Practice*, (Pratt, Henson, & Cargill, 1998) Pratt observed:

> An alarmingly large proportion of musicians, questioned about their own experiences of aural training, admit that they disliked it, thought they were bad at it, and have found it largely irrelevant to their subsequent engagement in music. Something is clearly wrong.

> Aural perception is self-evidently indispensable in musical activity, in creating through composing, re-creating in performance, responding as critical listener. Either many musicians should have taken up other careers, as brain-surgeons, say, or bookmakers, or else the content and methods of aural training and testing are inappropriate to their presumed purpose of developing musical perceptions. (p. 1)

It is the purpose of this study to review the recent research on cognition and learning and apply these findings to aural skills training. Particular attention will be paid to the reinforcement of the techniques and skills that are used in the classroom; specifically in the use of computer mediated practice outside of the classroom. There has been a lot of attention in the last few years given to techniques of active learning where the student is closely involved with the subject and their own learning process. Having the student make associations between the new material and material already familiar is among the most frequently used techniques (Novak, 2002). Associative and active learning has long been a part of the classroom instruction in aural skills; however, out-of-classroom practice, and particularly computer mediated practice, does not reinforce the techniques employed in the classroom (Higgins, 1992; Karpinski, 2000).

This section will first review the pertinent research regarding music perception and learning and then focus on the techniques of active learning and the process of concept mapping. Since there is a dearth of research on concept mapping as it applies to the specific area of this study (chord recognition), this review will focus on the use of concept mapping in other disciplines that might have some relevance to music.

2.2. AURAL SKILLS

Aural skill training consists of several components; sight-singing, dictation, and identification of musical elements. The focus of this study is on the component of identification of musical elements. While many researchers have shown that the identification of musical elements out of musical context is irrelevant (Cuddy & Upitis, 1992; Fiske, 1992 ; Gordon, 2003 ed,; Karpinski, 2000), the discrimination of elements such as chord quality is an important aspect of musical perception (Davidson & Script, 1992). Such discrimination is part of the expansion of musical awareness and is a necessary part of analysis and identification of musical elements (Pratt et al., 1998).

Many persons believe that perfect pitch—the ability to correctly identify specific pitches aurally—is the ultimate endowment for a musician (Ward & Burns, 1982). This notion, however, is in contrast to the research that music is perceived in context (Cuddy & Upitis, 1992). Students with perfect or absolute pitch (AP) tend to extract individual pitches from a melody, interval or chord and proceed to analyze them (Marvin, 1995). Students with AP, as well as other students, should be encouraged to listen in context. This would also apply to recognizing chords by their individual and unique sonic quality rather than by static analysis.

While much of current aural skills training is centered around drill and practice of individual elements (Karpinski, 2000), Pratt suggests exercises to look for listening opportunities in everyday activities (Pratt et al., 1998). This is consistent with other pedagogical research that suggests that learning is best when linked to one's own knowledge (Jonassen, 1991; Novak, 2002). Other research in music perception has suggested that listeners should link what is heard with what they already know. Zalanowski (1990) in a study on music appreciation asked the students "to describe any images they had while listening to the music" (p. 200). Another study linked sight-singing with reflective writing (Davidson, Scripp, & Fletcher, 1995). The authors had students at the New England Conservatory of Music maintain a journal in which they wrote about their work and progress in class. The students were also assigned readings about which they had to write and apply to their theory (aural) skills classwork. The authors found a strong positive correlation between the students' scores on departmental performance exams and the quality of their reflective thinking (p. 23).

Hopkins (2002) compared the use of "discovery" learning (learning where the learner takes an active role in organizing the material to be learned) with more traditional "expository" learning (characterized by the teacher organizing the material) methods on the aural recognition of music concepts. The material in this study was presented using Computer Based Instruction (CBI). Two versions were created for each group. The expository learning group was given examples with descriptions and explanations. The discovery learning group were given the examples but were asked to develop their own descriptions of the examples; a process consistent with studies in constructivism and active learning. Although the study did not show a significant difference in favor of discovery learning it did show that discovery learning was at least as effective as the more traditional approach. This particular study, however, was hindered by a small (n = 27) sample size.

Another study distinguished between two fundamentally different approaches to aural skills training; perceptual and structural (Brink, 1980). The perceptual approach concentrates on the sonic event whereas the structural approach emphasizes the musical process (context). She contends that the perceptual approach—the traditional behaviorist approach—can result in fragmented listening. The structural approach, which can encompass the perceptual, is more in keeping with findings on learning and cognitive psychology that favor contextual learning. Buehrer (2000) proposed a new paradigm for aural skills that encompassed a constructivist approach. He contends that "constructivism has great potential for implementation into aural skills curricula" (p. vii) and proceeds to offer a proposed textbook that incorporates active learning and constructivist principles.

2.3. COMPUTER MEDIATED INSTRUCTION

The studies above show an improvement in aural skill development when the student is more actively involved in the learning process. However, many of the present practice methods in aural skills do not employ these active learning techniques, especially in the area of computer assisted or computer mediated practice. A recent review of computer software for aural skills training showed that although the quality of the software, particularly the sound and graphics, was greatly improved, the basic methodology was still drill and practice (McGee, 2000). Karpinski (2000) writes "When we deliver the same old tired pseudo-pedagogy—for example, an interval tutor or chord spelling drill—using flashy new technology, we simply reinforce poor concepts and faulty learning strategies in more seductive ways" (p. 5). He further states that it is not the computer that is the problem, but the instruction.

At issue here is how to involve the learner in both sonic perception and mental analysis of the stimulus; how to actively involve the learner. Baltzer (1996) writes "music is an aural art, yet most students are visual learners" (p. 33). He goes on to suggest that "Listeners will be more attentive if they are engaged visually as well as aurally" (p. 33). Studies have shown that cognition and learning are enhanced when information is presented and processed in several modes (Craik & Lockhart, 1972; Hartman, 1961; Paivio, 1978). Hartman's study was concerned with the simultaneous presentation of information in audio and visual channels. However, Craik and Lockhart proposed that there was deeper understanding when a stimulus was processed, not just perceived, by several channels. They write: "After a stimulus has been recognized, it may undergo further processing by enrichment or elaboration. For example, after a word is recognized, it may trigger associations, images or stories on the basis of the subject's past experience with the word" (p. 675). They also suggest that "similar levels of processing exist in the perceptual analysis of sounds, sights, smells and so on" (p. 675).

Paivio (1978) proposed two distinct symbolic systems; one for verbal and another for non-verbal information. His study used pictures and objects for the nonverbal or environmental information compared with words as being communicative information. The nonverbal or environmental information is stored in the long-term memory in a perceptual form and accessed by non-verbal objects. Communication, verbal, information can be used to describe nonverbal objects, but the two are processed separately. It is logical to assume, based on the work of Craik and Lockhart, that if verbal information can be combined with nonverbal information during processing, it will be understood better. His studies also showed that if different information is perceived at the same channel at one time, there is a conflict and the information will not be processed or remembered well.

For Baltzer (1996) a way to bridge the gap between aural and visual was the use of "listening maps." These maps used images combined with words to help the listener understand the form and structure of a piece of music better than if they were only listening and trying to imagine the form and structure. That is, the listening maps helped the listener process the information in separate channels.

Although listening maps have been used in music as a way to describe structure and form for students in music appreciation courses and also for children learning about music, there is no evidence of the use of mapping in other music courses or aural skills courses. However, the research in aural skill training and cognition all indicate that the process of concept mapping should result in more effective retention of the material being learned.

2.4. CONCEPT MAPPING

Concept mapping (CM) was developed by Joseph Novak (1984) based on the theories of David Ausabel (1963) as a way to improve the "construction" of knowledge (p. 4). According to Novak, "To learn meaningfully, individuals must choose to relate new knowledge to relevant concepts and propositions they already know" (Novak & Gowin, 1984, p. 7). Since its development, CM has been used in a number of disciplines and in many educational settings. Although there are no reports of the use of CM in relation to aural skills training, one researcher found a strong positive correlation between musical-rhythmic intelligence [*Frames of Mind: The Theory of Multiple Intelligences* (Gardner, 1983)] and concept mapping complexity in preservice teachers (Burke, 1998). The researcher suggested that "successful concept mapping and musical ability draw upon similar cognitive processes" (p. 139): in particular, the use of abstract symbol systems as representations of information.

As a learning tool, CM has shown positive results in a number of areas. A study by Ruiz-Primo and Shavelson (1996) on the use of concept maps in science teaching showed, among other things, consistent correlations between the quality of students' concept maps and their overall student achievement. Romance and Vitale (1999) reported several other positive results, one in an astronomy course and another in a biology class. Teachers in these classes described "significantly better student learning and retention" (p. 4). Concept Mapping has also been applied to the area of communication. Freeman and Jessup (2004) did a study on the use of CM in client-consultant interactions. Among their findings they suggest that concept maps could include affective concepts such as emotions and feelings as well as facts. They concluded that CM proved to be a useful communications tool.

While CM can be used in individual classes, it has also been the basis for developing successful study skills and habits in school children. Novak (1993) describes a method he previously developed to promote "meaningful learning" (p. 51) which he named "Learning to Learn" (p. 54). Heiman (1985) reported the success of this program in several Boston, Massachusetts area schools as well as in schools on Long Island, New York and Cincinnati, Ohio. In each of the schools, Learning to Learn programs produced positive outcomes. Students were more actively engaged in their work, improved basic skills (primarily in reading, writing and listening), were more motivated and showed a higher level of class participation. A similar program called "Thinking Maps" (Hyerle, 1995) used in schools in Goldsboro, North Carolina and Atlanta, Georgia showed an 11% gain in student scores on standardized writing tests.

A study by Heinze-Fry and Novak (1990) used both quantitative and qualitative tools to measure the effect of concept mapping on the students' scores on an exam and verbal recall of information. The results were also correlated with the students' SAT scores. While the findings showed no significant difference between the CM group and the control group on the initial exam, the CM group did show higher retention at the five-month period following and also better verbal recall. A questionnaire indicated that the CM group had very positive attitudes towards CM and would continue to use it in other work. Separating the CM and control groups by high (1260-1460) and low (950-1250) SAT scores showed a similar result for the high SAT group. That is, while the initial test results were not significantly different, retention was better at the five-month period. The low SAT group did not show any difference either in initial test scores or retention. However, the experience using CM by several low SAT students resulted in improved scores in other subjects where they applied what they had learned about the CM process. Overall this study showed that CM improved retention as well as developed positive attitudes towards studying using the CM process.

Horton et al. (1993) performed a meta-analysis on studies of the effectiveness of CM in the classroom. From the nineteen studies found, the results showed moderate improvement in student achievement using CM but very positive attitude improvement by those using CM. These results corroborated the Heinze-Fry/Novak study (which was included in this study). Although all the studies included were from science subjects (Novak was a biology teacher), a major finding is that there is a positive attitude improvement towards studying and learning with those who used CM. Attitude towards learning is not something unique to the sciences, but is universal. What is clear however, is that getting the learner to become more actively involved in the learning process, whether the subject matter is science or aural skills, is essential.

2.5. ORIENTATION TO THE PRESENT STUDY

From the above review of the literature and research, several points are clear. First, aural skills training could be enhanced through the use of active learning techniques. Second, although many instructors use these techniques in the classroom, practice methods, especially computer based practice, does not employ these techniques to reinforce classroom teaching. Hopkins notes "Research in music education comparing discovery and expository methods of instruction is scarce and has been largely inconclusive" (Hopkins, 2002). Third, the research also shows that one of the most effective means of using active learning is through the use of concept maps. Active learning, learning where the learner is involved in the learning process by organizing the material and applying it to their own context and knowledge, is the central component of constructivism and concept mapping (Jonassen et al., 1999; Novak, 2002).

Beuhrer's study and proposed curriculum using constructivist techniques contends that reflective thinking is at the core of this instruction (p. 82). Furthermore, both the studies by

Zalanowski (1990) and Davidson et al., (1995) found that reflective thinking had a positive influence on learning in music. Reflective thinking, as well as association, are the chief elements in concept mapping. It would appear that the use of this technique could result in better acquisition of aural skills.

Other studies have shown the benefits of multi-modal processing (Craik & Lockhart, 1972; Hartman, 1961; Paivio, 1978). The present study will take advantage of this research and will use the computer to mediate the information. The sounds will be presented on an individual computer while the participant completes the concept map using pencil and paper. This will allow the participant to concentrate on the sounds thus providing time for reflection and interaction with those sounds while they prepare their concept maps.

Concept mapping has been an effective pedagogical tool, not only in the sciences (Novak, 1990) but also in a variety of other areas (Freeman & Jessup, 2004; Hoover & Rabideau, 1995; Horton et al., 1993; Hyerle, 1995; Kankkunen, 2001; Romance & Vitale, 1999). Concept mapping employs the process of active learning which has been shown to be an effective learning tool (Abellonio, 2001; Brunnemer, 2002; Catello, 1999; Loundas, 2001; Wilke, 2000) and also the process of multiple channel processing (Craik & Lockhart, 1972; Hartman, 1961; Paivio, 1978). The question this study examined is whether aural information in the form of chords can be used as a non-verbal stimulus as well as the verbal main concept to which other concepts, verbal and non-verbal, can be attached by the user to make more meaningful propositions that will improve the recall of the aural information. The goal of this study was to find a way to incorporate active learning with computer mediated practice.

Studies in aural skill pedagogy show an improvement when active learning techniques are employed (Brink, 1980; Buehrer, 2000; Davidson et al., 1995; Hopkins, 2002). Studies in other disciplines have shown that the active learning (constructivist) technique of concept mapping has a positive effect on learning (Abellonio, 2001; Brunnemer, 2002; Catello, 1999; Loundas, 2001; Wilke, 2000). However, other than Burke (1998) who found a positive relationship between musical ability and effective concept mapping, no studies were found that combined the technique of concept mapping and aural skill acquisition or practice. Clearly, research in this area is needed.

3. METHODOLOGY

3.1. INTRODUCTION

Technology has long been a part of aural skills training and practice. Sound recordings in the form of vinyl records were the first to offer the teacher and student the ability to study these techniques away from a piano or other instrument. For many years, tape recordings were the mainstay of practice materials in music and aural skills. Personal computers were employed early in their introduction, but the sounds produced were not very natural and it was often difficult to discern accurate pitch. Compact disks have now replaced the cassette tape and current computers have the ability to produce sounds that are difficult to distinguish from the original instrument. Although there has been much research and development in the area of aural technology, there has been little evidence of research in the improvement of educational methods in aural skills, especially methods that use this improved technology.

3.2. RESEARCH DESIGN

This study employed a pretest-posttest, equivalent-group design using a treatment and a control group to examine the effect of the independent variable (concept mapping) on the dependent variable (chord recognition). Students were randomly assigned to one of the two groups prior to the beginning of the experiment. All the material was prepared on web pages written in Hypertext Markup Language (html) and mediated by a personal computer. For each group (experimental and control) there was a pretest, lesson, and a posttest. The material for the pre- and posttest was the same for both groups. An analysis of covariance (ANCOVA) was employed using the pretest as the covariant in order to reduce error variance and eliminate systematic bias (Dimitrov & Rumrill, 2003). The model for this design, also known as a Two-Group Control Group Design can be seen in Figure 5 below (*Pretest/Posttest Comparison*, 2003).

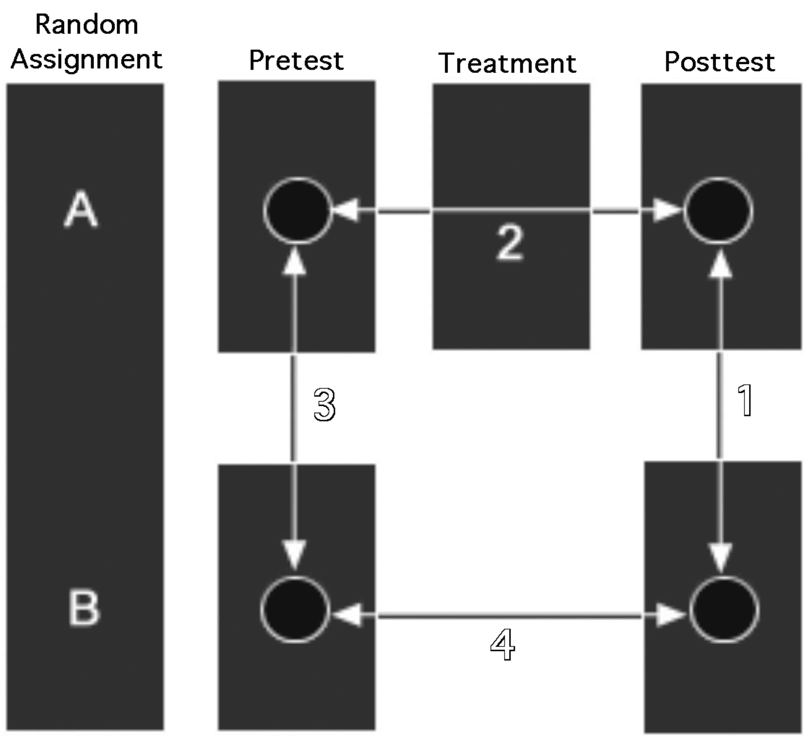


Figure 5 - Analysis model

Using this model, comparisons can be made between: (1) the treatment group and control group; (2 & 4) gain scores of both groups; (3) equivalency of random assignment; (4) effect of distractor treatment (if any). For the present study, both groups listened to the chords three times during the lesson (treatment); however, the control group was given a filler task while listening to the chords in order to reduce any confounding effect of the pretest on the posttest. Because this study only tested the effect of the treatment and did not compare other pedagogical techniques, the filler task was a non-musical exercise.

3.3. PARTICIPANTS

The participants in this study were all students at Indiana University of Pennsylvania (IUP) enrolled in the first semester aural skills class (Theory Skills I, MUSC 111). There were four sections of this course with a total enrollment of 70 students. Sixty-four (91%) took part in the study. Of these, 61 were freshmen and 3 were sophomores. All but one participant were majoring in one of three degree programs: Bachelor of Arts (BA) in Music, Bachelor of Fine Arts (BFA) in Music Performance, and Bachelor of Science (BS) in Music Education. However, there were two participants who had not yet declared a major either because they had not taken an audition, or did not pass their first audition. All the other participants (61) had been accepted into the IUP Department of Music by competitive audition; however, students at IUP are not required to take a test of aural skills or music theory as part of their audition. Because of the manner by which these students were admitted, they could be considered representative of other music students at comparable institutions.

Prior to the beginning of the experiment, each group of students (class section) was given an explanation of the study and a release form (Appendix A1). Participation in the study was completely voluntary.

3.4. INSTRUCTIONAL MATERIALS

All students received a packet of materials when they came to do the experiment. There were two different packets prepared; one for the concept mapping treatment group and another for the control group. Participants who were pre-assigned to the experimental treatment group received a description and example of concept mapping (Appendices C1-2) as well as five blank concept map templates (Appendices C3-7). The type of chord was displayed as the central concept with several boxes linked to it along with connector lines with places to add text describing the relationship of the boxes to each other. Two websites were given at the end of the concept mapping treatment page if the participant wanted further explanation and instruction in the use of concept maps.

The participants were instructed to listen to the chords and make whatever links and thoughts they had to describe the chord. Each chord type was presented as a series of ten chords of that type from the chord stimulus pool. Five chord types were represented: major, minor, diminished, augmented, and dominant seventh. A stimulus pool containing ten examples of each chord type (50 total) in various keys and inversions was used as the base for the pre- and posttest (Appendix B1). The chords were all four note chords within the range of C3 and G5 (C4 = middle C). Each chord was saved as an MP3 audio file using a sampled piano sound. Each set of ten chords used a variety of keys and chord inversions so that the only similarity was the quality of each chord type. Participants were prompted to make their own boxes containing descriptions of the sound or thoughts about the sound and then make links to the initial element as well as other nodes in the map.

Participants in the control group received a packet containing instructions (Appendix C8) and five worksheets (Appendices C9-13), one for each chord type. Each worksheet contained two anagrams that related to their coursework. One anagram was the name of one of the chords in the pool; major triad, minor triads, diminished triad, augmented triads, and dominant seventh. Only the major triad was on the worksheet labeled “Major,” the others were placed on different worksheets to avoid the obvious connection. The other anagram was a term relating to their aural skills class. These were: aural skills, ear training, solfegio, solfege, and sight singing. Participants in this group also listened to the chord groups, but they worked on the anagrams instead of making concept maps.

3.5. INSTRUMENTATION

All the materials for this study, including the information as well as data collection, were mediated by WebCT. WebCT is an environment that offers testing and documentation of individual users as well as an easily accessible medium to present the information needed in the study. WebCT is an on-line delivery system that presents information prepared as web pages in html and also organizes the information, handles navigation to each page within the system and keeps records of the users. It has the capability of creating quizzes containing random test questions generated from a pool of questions and to grade these quizzes. Entry into the system is open only to those assigned by the instructor. It also can selectively show certain materials to subgroups as assigned by the instructor. WebCT saves data on when a user accessed the system, what pages they viewed as well as keeping records of quiz grades.

The tests of chord recognition were the central component of this study. Both the pretest and posttest were identical except for the specific order and content of the chords. Each test presented twenty-five (25) chords selected at random from the same pool of fifty chords. Each chord was given one at a time and there was a fifteen (15) minute time limit to complete the test. The participants would listen to each chord and then select one of the five chord qualities as the answer (Figure 6).

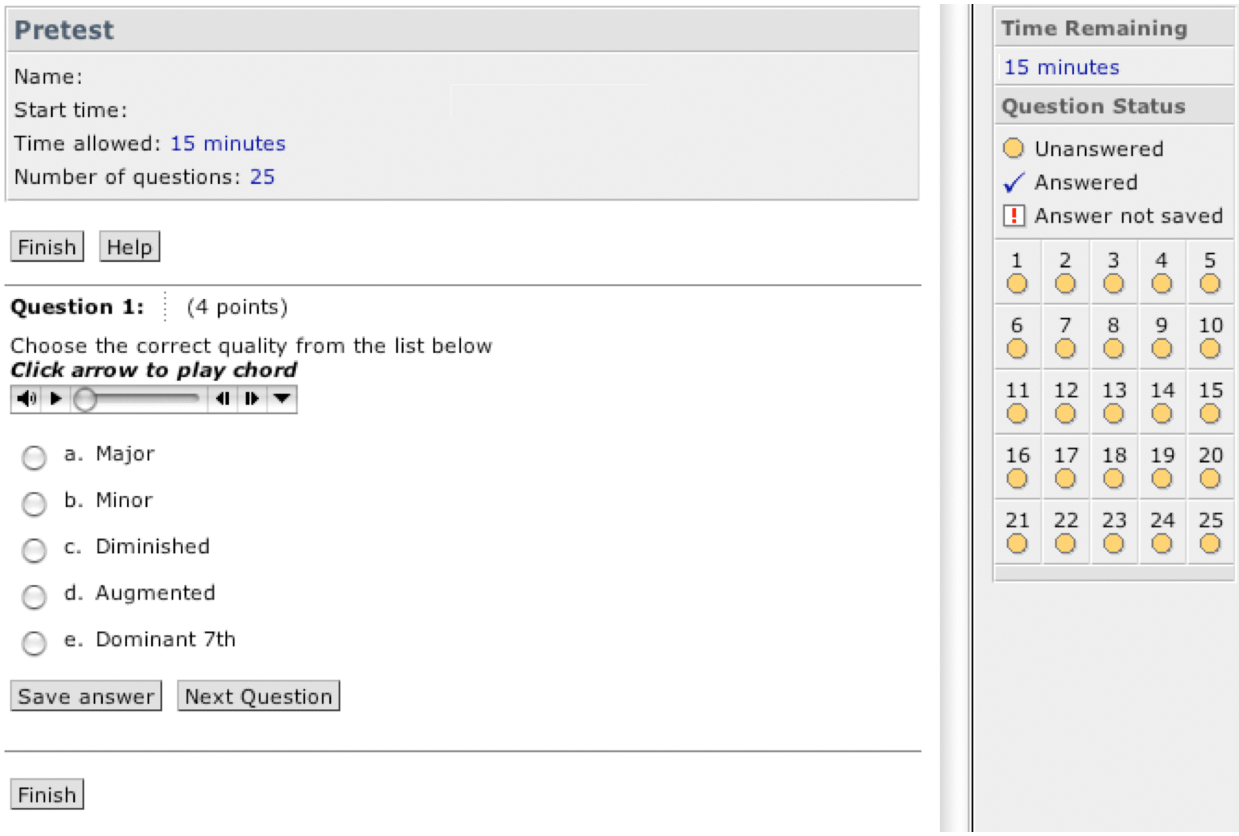


Figure 6 - WebCT Question screen

In WebCT the user is required to first save the answer and then select the next question. WebCT also keeps a chart of each question answered and warns the user if a question has not been saved. Once a question has been answered, the user could not return to that question. When the student answered all the questions, they were prompted to press the Finish button to submit the test to WebCT for grading. Scoring was done automatically and stored in a database maintained by WebCT. To eliminate any effect of their performance on the test, the score was not shown to the student. Each test could only be taken one time and the posttest did not appear as a choice until the pretest was completed.

3.6. PROCEDURE

The study was done in the computer lab in the College of Fine Arts, Indiana University of Pennsylvania. Participants took one class period in the lab to complete the project. When participants logged in to the study in WebCT (Appendix B2), they were presented with an introduction page with instructions for completing the project (Appendix B3). They were instructed to go first to the pretest where they were asked to identify twenty-five (25) chords presented at random from a bank of fifty (ten in each category). The chords were presented one at a time and the student chose the answer from one of five types; major, minor, diminished, augmented and dominant seventh. There was a fifteen (15) minute time limit to complete the test and the test could only be taken one time. When they completed and submitted the test, they were given one of two pre-determined treatments: the experimental treatment lesson (CM) (Appendix B4) or the control treatment lesson (Appendix B5). After working through the lesson, the participants then took the posttest, which was another set of 25 chords chosen at random from the same pool of 50. This was identical to the pretest except for the exact content and order. Following the pretest, both groups received a lesson task. The treatment group received a lesson on concept mapping and the control group received a filler task. Both groups listened to the chord sets three times while performing the assigned task.

Participants in the experimental treatment group were instructed to open their packet of materials. The packet contained instructions, an example of concept mapping and five blank concept maps; one for each type of chord in the stimulus pool. The computer screen prompted the participant to choose one of the chord types. The next screen (Appendix B5) gave basic instructions for preparing their maps and had a button to play the chords. The participants could choose when to play the chords and were given three opportunities to do so. The computer screen displayed the number of plays. When the chords were played the third time, the participant was returned to the opening screen of the lesson to choose another chord type. When all chord types were completed, participants were prompted to take the posttest. They were also prompted to save their completed maps and return the packets to the researcher.

Following the pretest, the participants in the control group were taken to a lesson on "Chord identification and Musical Terms." The opening screen (Appendix B6) gave instructions for the lesson and prompted the user to choose one of the chord types. The next screen gave basic instructions to follow the directions on the chord worksheet in their packets and began playing the chosen chord set. After the chord set played, there was time for the participant to work on the worksheet, which asked them to unscramble two anagrams of terms related to their class and one of the chord types in the stimulus pool. After one minute the chords played a second time followed by 50 seconds of silence to work on the anagrams. The chord set automatically played a third time, again followed by 35 seconds of silence before going to a final screen (Appendix B8) that prompted them to go on to the next set of chords and worksheet whether or not they had completed the anagrams. Each group of participants (treatment and control) listened to the chord sets three times. The participants in the treatment group, however, controlled when they heard each set. The chord sets in the control group played automatically and the timings were based on the average time students took to work on the concept mapping task during pilot testing.

3.7. DATA TABULATION

All the data from the pre and posttest was collected and saved by WebCT. This information, including student identification, was transferred in tabular form for statistical analysis. Student identification was used to place the scores of the pre- and posttest into the correct blocks for analysis. Once the scores were correctly blocked and stored, student identification was eliminated and all individual results were anonymous and confidential. Statistical analysis and results follow in the next chapter.

4. RESULTS OF EXPERIMENT

4.1. INTRODUCTION

To determine if the process of Concept Mapping was useful as a practice tool in aural skills training, one primary question was developed: Can the construction of a Concept Map while listening to chords improve recognition of these chords as shown by a statistically significant difference between a pretest and posttest of randomly selected chords? In order to answer this question, comparisons were made between the mean scores of the pretest and posttest for the treatment and control groups, as well as the difference scores (gain) between the pre- and posttest for the two groups. An Analysis of Covariance (ANCOVA) was also performed using the pretest as the covariate.

Of the sixty-four (64) participants, one student scored zero (0) on both the pre- and posttest. An examination of the test entries (recorded by WebCT) showed that the participant did not complete each question by pressing the "Save Answer" button. The WebCT Quiz program automatically produces an error message and a prompt to save the answer before continuing the quiz. This message was apparently misunderstood or ignored by the participant. Another participant failed to take the posttest following the treatment. Because of these errors, both students were omitted from the analysis.

4.2. QUANTITATIVE ANALYSIS

4.2.1. Treatment-Control Group Comparison

A comparison was made between the treatment and control groups for the pretest to determine the equivalency of the groups and to establish baseline comparability of the pretest. An Independent Samples t-test (Table 1) showed no statistical significance between the groups.

Table 1 - Groups Comparison, Pretest

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Treatment	30	47.467	16.33218	2.98184
	Control	32	48.125	15.88619	2.80831

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pretest	Equal variances assumed	.018	.893	-.161	60	.873	-.6583	4.09237	-8.844	7.5276
	Equal variances not assumed			-.161	59.483	.873	-.6583	4.09609	-8.853	7.5365

4.2.2. Section Comparison

There were four (4) separate sections of the Aural Skills class (MUSC 111) each taught by a different instructor. The basic syllabus and target skill level was the same for each section. Teaching methods, however, varied with each instructor. Again, a comparison was made of the section means to determine equivalency of the groups. While there is some variation between the means (Table 2), one-way ANOVA's were not statistically significant between sections for the pretest, $F(3, 58) = 2.539$, $p = .065$, the posttest, $F(3, 58) = 1.265$, $p = .295$ and the gain score, $F(3, 58) = 1.144$, $p = .339$. Because the sections did not differ significantly, data were collapsed over section for all subsequent analyses.

Table 2 - Section Means

	Section 1	Section 2	Section 3	Section 4	Total
N	13	18	12	19	62
Pretest	56.29	44.44	41.33	48.84	47.81
Posttest	58.46	46.44	51.00	50.32	51.03
Gain	1.54	2.00	9.67	1.47	3.23
Std. Deviation of the Gain	10.14	11.58	16.58	14.80	13.49

4.3. PRETEST/POSTTEST ANALYSIS

4.3.1. Pretest/Posttest: Gain Scores

Several tests were performed on the difference between the pre- and posttest scores. These comparisons revealed interesting results that will be discussed in detail in the next section. The primary test for this study was an ANCOVA with the gain score as the dependent variable and the pretest as the covariate. The purpose of this test, according to Bonate, is to "remove the influence of the pretest on the posttest" and to answer the question, "are the treatment effects different between groups when applied to individuals with the same baseline score?" (Bonate, 2000). Bonate also noted that the results using gain scores as the dependent variable are exactly the same as those using the posttest as the dependent variable.

The results, summarized in Table 3 below, showed no significant difference between the Groups $F(1,61) = 1.398$, $p = .242$. There was a significant effect of the ability of the Pretest score to predict the Gain score, $F(1,61) = 7.209$, $p = .009$.

Table 3 - ANCOVA Results

Between-Subjects Factors

		N
Group	Treatment	30
	Control	32

Tests of Between-Subjects Effects

Dependent Variable: Gain Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1558.265[a]	3	519.422	3.158	.031
Intercept	1662.029	1	1662.029	10.104	.002
GROUP	230.000	1	230.000	1.398	.242
PRETEST	1185.776	1	1185.776	7.209	.009
GROUP * PRETEST	118.518	1	118.518	.721	.399
Error	9540.573	58	164.493		
Total	11744.00	62			
Corrected Total	11098.84	61			

a. R Squared = .140 (Adjusted R Squared = .096)

4.3.2. Means Summary

A comparison of the posttest scores showed no difference between the treatment and control group (Table 4).

Table 4 - Groups Comparison, Posttest

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Treatment	30	52.800	16.38839	2.99210
	Control	32	49.375	17.99238	3.18063

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest	Equal variances assumed	.590	.445	.782	60	.437	3.4250	4.38017	-5.337	12.187
	Equal variances not assumed			.784	59.954	.436	3.4250	4.36682	-5.310	12.160

Table 5 shows the mean (*m*) scores for each group as well as the median (*Mdn*) and standard deviation (*SD*) for the pretest, posttest and gain. Also included are the adjusted mean gain scores, calculated from the ANCOVA. It can be observed from this table that there is a larger mean gain for the treatment group (M = 5.33) than for the control group (M = 1.25). Observation of the standard deviations for each group indicates a wider spread of scores between the pre- and posttest for the control group than for the treatment group.

Table 5 - Group Means Summary

Group		Pretest	Posttest	Gain	Adjusted Gain*
Treatment	N	30	30	30	
	Mean	47.47	52.80	5.33	5.24
	Median	46.00	52.00	8.00	
	Std. Deviation	16.33	16.39	13.99	
Control	N	32	32	32	
	Mean	48.13	49.38	1.25	1.34
	Median	52.00	50.00	0.00	
	Std. Deviation	15.89	17.99	12.91	
Both	N	62	62	62	
	Mean	47.81	51.03	3.23	3.22
	Median	48.00	52.00	2.00	
	Std. Deviation	15.97	17.18	13.49	

**Evaluated at adjusted mean: Pretest = 47.8065*

An interesting observation from this table reveals that although there was a small increase in the mean for the control group, the group median went down from *Mdn* = 52 for the pretest to *Mdn* = 50 for the posttest. The median for treatment group, however, increased from a *Mdn* = 46 in the pretest to *Mdn* = 52 in the posttest. Because each question was worth four points, the Gain Score medians are not the difference between the pre- and posttest medians: Treatment Group (*Mdn* = 8), Control Group (*Mdn* = 0). This difference is more obvious when the gain scores are compared graphically as boxplots (Figures 7, 8 and 9). In each boxplot, the center line indicates the median score for the set.

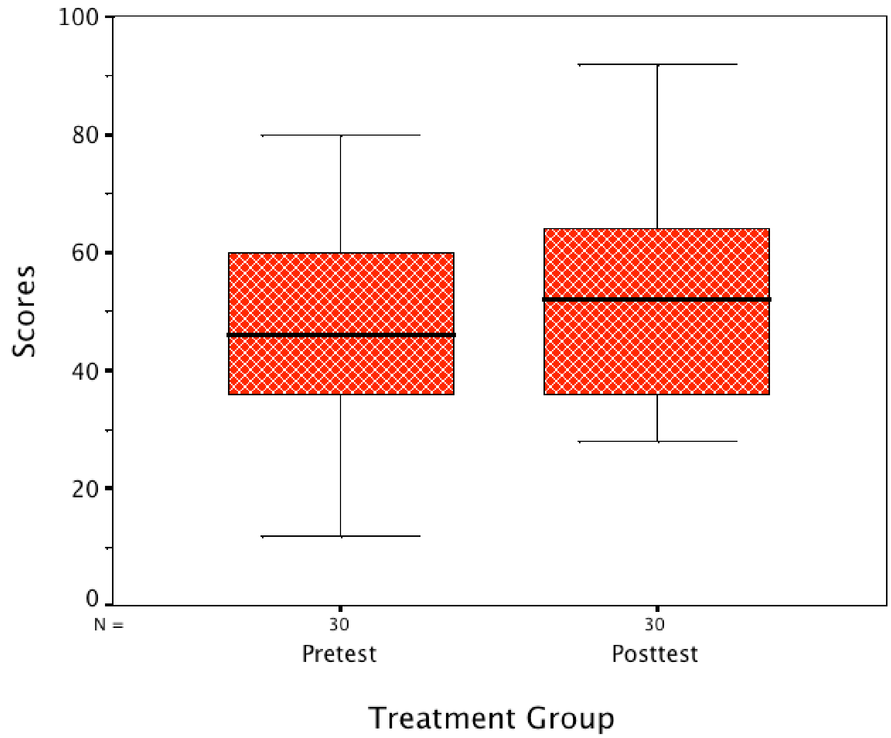


Figure 7 - Pre/Posttest Comparison, Treatment Group

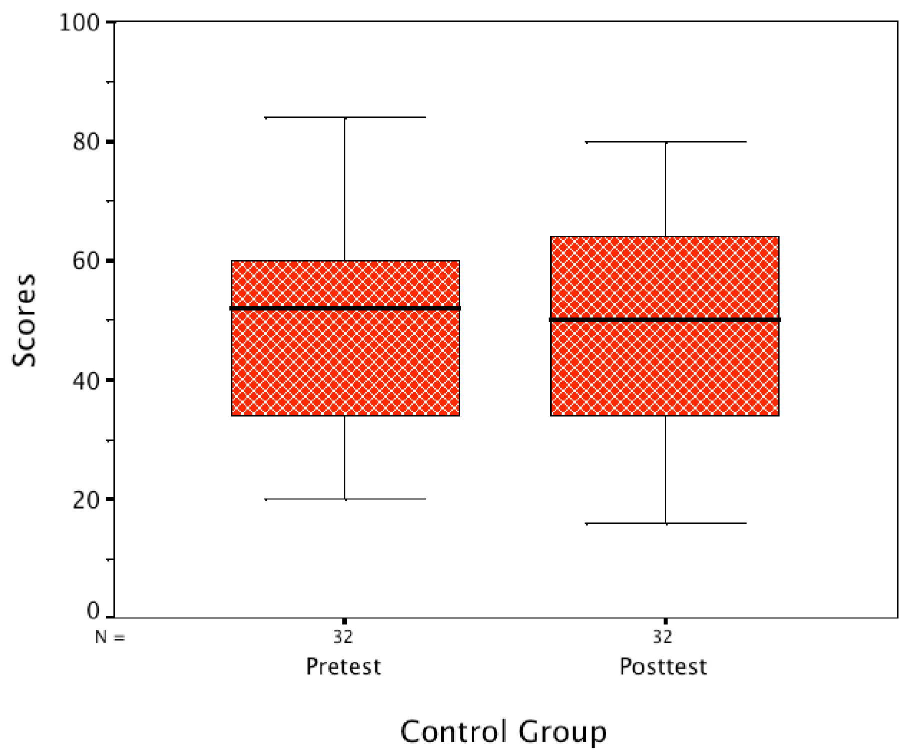


Figure 8 - Pre/Posttest Comparison, Control Group

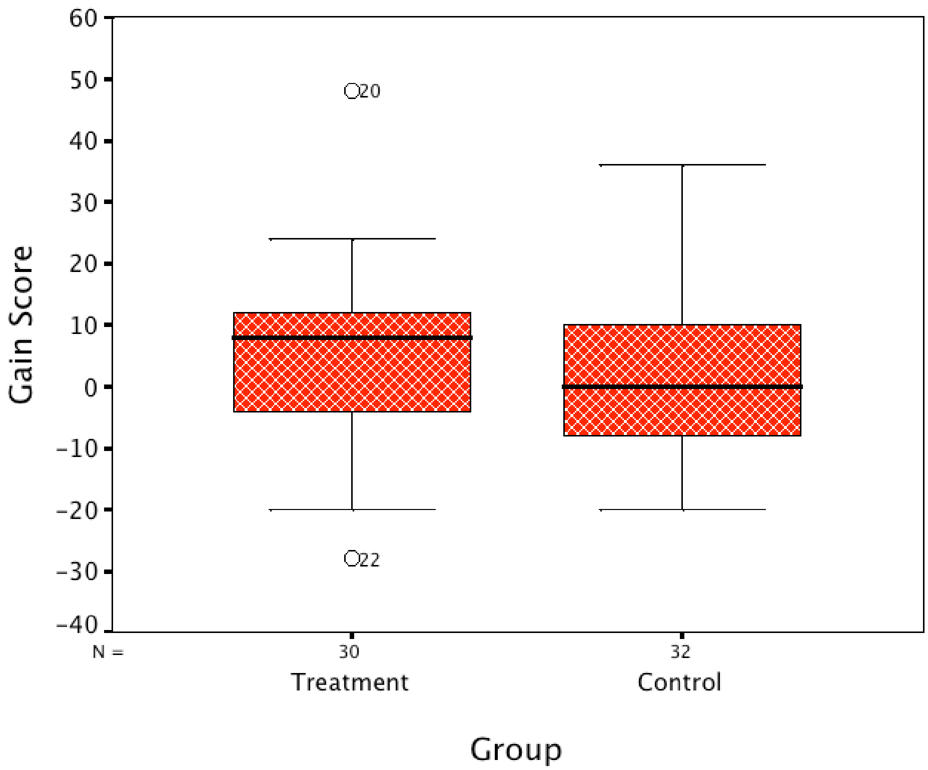


Figure 9 - Gain Score Boxplot

Figure 9 indicates the existence of two outliers according to the default criteria of SPSS. An examination of these scores showed one to be a gain of +48 and the other –28. Because outliers can affect results, all tests of significance involving these two gain score outliers were done again with both removed. No result changed. Consequently, only the results of the original tests are reported here.

A paired-samples t-test (Table 6) comparing the difference (gain) scores—posttest minus pretest—of each group shows a significance of $t(29) = 2.088$, $p = .046$ (2-tailed) between the pre- and posttest scores of the treatment group. An independent samples t-test (Table 7) comparing the means of these two groups, however, shows no significance between the groups. This is due to the difference between the pretest means. The treatment group pretest mean, M = 47.4667 was lower than the control group mean, M = 48.1250. When these values are used, the gain for the treatment group is M = 5.33. However, when the means for the two groups are adjusted for baseline equivalence (Table 5), the gain is now M = 5.24 with non-significance of $t(29) = 1.957$, $p = .060$ (2-tailed).

Table 6 - Group Gain t-test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Treatment:	Posttest	52.8000	30	16.38839	2.99210
	Pretest	47.4667	30	16.33218	2.98184
Control:	Posttest	49.3750	32	17.99238	3.18063
	Pretest	48.1250	32	15.88619	2.80831

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Treatment:	Posttest - Pretest	5.3333	13.98850	2.55394	.1099	10.5567	2.088	29	.046
Control:	Posttest - Pretest	1.2500	12.90911	2.28203	-3.4042	5.9042	.548	31	.588

Table 7 - Group Comparison, Gain Score

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Gain Score	Treatment	30	5.3333	13.98850	2.55394
	Control	32	1.2500	12.90911	2.28203

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Gain Score	Equal variances assumed	.012	.914	1.195	60	.237	4.0833	3.41596	-2.750	10.916
	Equal variances not assumed			1.192	58.756	.238	4.0833	3.42495	-2.771	10.937

4.3.3. Pretest-Posttest: Time Analysis

After running the previous tests and observing the results, the investigator noticed what might be an important contributor to the overall results of the experiment. An analysis of the negative gain that occurred in some scores in both groups indicated a possible correlation between the time spent on the tests and the posttest score. Two different comparisons were made 1) the total time taken for both tests compared with the gain score and 2) the difference of time between the pre- and posttests compared with the gain score (Figure 10). Table 8 shows the summary of the times for each group.

Table 8 - Test Time Average

Group	Pretest	Posttest	Combined	Difference
Treatment	6:14	5:54	12:09	(0:20)
Control	6:30	5:17	11:47	(1:13)
Both	6:22	5:35	11:58	(0:47)

It can be observed from these data that both groups took less time on the posttest than on the pretest. The control group spent an average of 1 minute 13 seconds less whereas the treatment group spent only 20 seconds less time. However, the control group did not spend significantly less time than the treatment group on both tests combined (0:12). The Treatment group showed a weak positive correlation of $r = 0.285$ with a non-significant $p = 0.127$. The Control group also showed a weak positive correlation of $r = 0.415$ but with a statistically significant $p = 0.020$. Individual scores ranged from a total time spent on both tests from 6:49 to 18:28. The time difference between the pre- and posttest ranged from –5:03 to 5:07 in the treatment group and –4:12 to 1:11 in the control group.

An examination of a scatter plot comparing the groups, showed a relationship that will be discussed further in the next section. The graph below (Figure 10) shows these comparisons. It can be observed from this graph that the majority of subjects in the control group showed a greater decrease in time spent on the posttest compared to the pretest than those in the treatment group. Furthermore, the time spent by the majority of the control group is below the mean (y axis) as well as gain scores that are also below the mean (x axis).

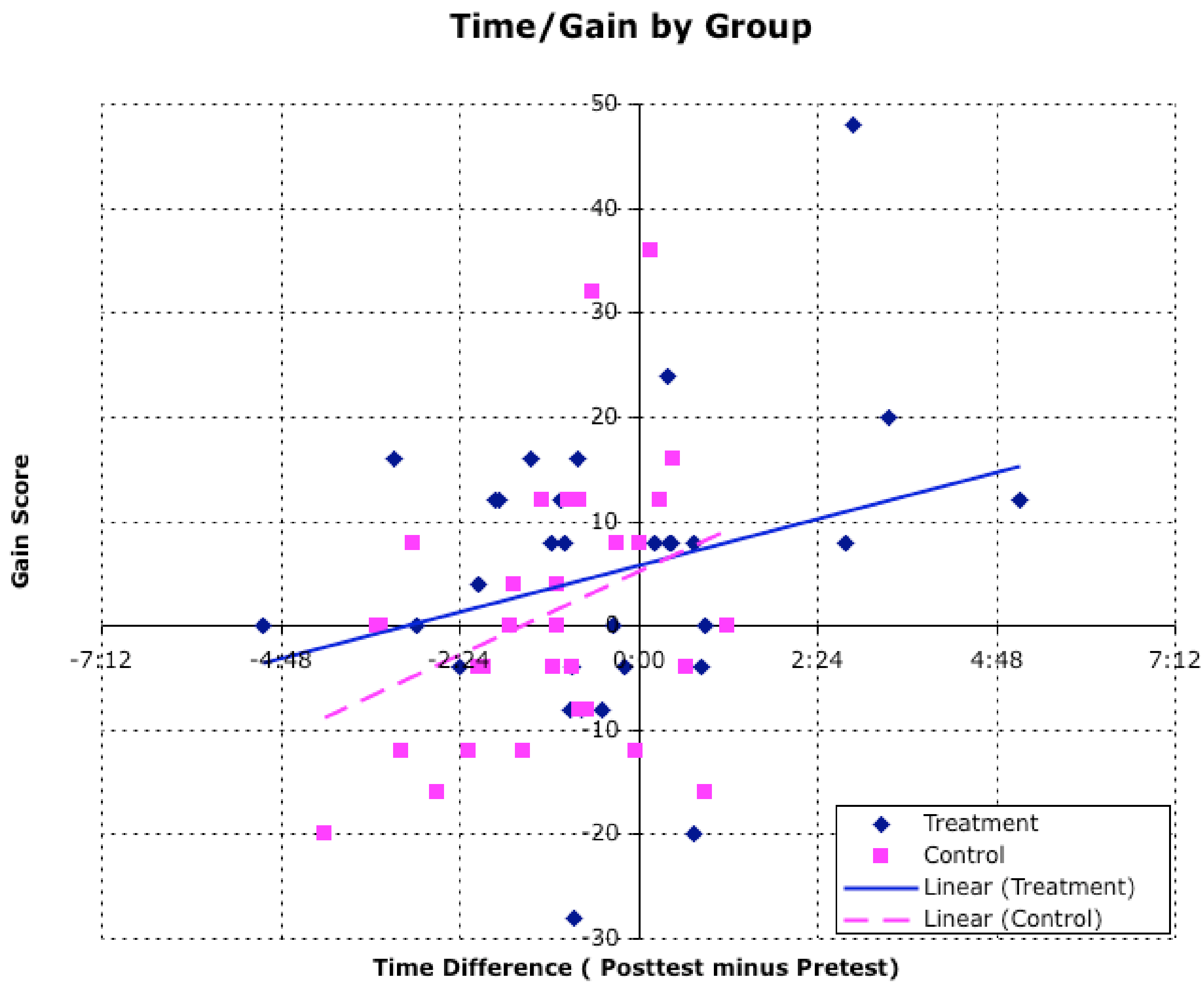


Figure 10 - Difference Time/Gain Comparison

In the graph above, the time difference between the pretest and posttest (posttest – pretest) is shown on the x axis and the gain score is shown on the y axis. As can be observed, a greater number of scores for the control group are to the left and/or below the center axis indicating a decrease in score (below) or time (to the left). The majority of the treatment group scores, however, are above or to the right of the center axis indicating that even though there was a decrease in time, the gain score increased.

5. SUMMARY AND CONCLUSIONS

5.1. INTRODUCTION

The purpose of this study was to determine if the process of concept mapping could be applied to aural skills practice in order to improve recognition of the aural elements of music such as chords and intervals and if this method of practice could be given using a personal computer. The goal was to find a more effective and efficient method for reinforcing the work done in the classroom. To guide this study, three basic research questions were developed:

1. Can the process of Concept Mapping be applied to aural stimuli?
2. Does the process of Concept Mapping of musical elements such as chords improve the recognition of those elements in a random test of chord qualities?
3. Can this process be mediated via a personal computer?

The three basic elements of this study, aural skills, concept mapping, and computer mediated instruction (CMI) are connected to each other as equal legs of a triangle. Each is important for creating an effective way to practice aural skills.

In order to answer these questions, a single-session experiment was prepared using students in a first semester college level aural skills class. The students came to a university computer laboratory and were given a pretest, lesson (treatment or control), and posttest on chord quality recognition. All the tests and lesson information were presented by a computer workstation using WebCT, an html based e-learning environment. Both the treatment and control groups were required to perform a task using pencil and paper while listening to the chords on the computer. WebCT recorded the scores for the pre- and posttest as well as the time taken to complete each test.

5.2. RESEARCH QUESTION 1

The first question that this study explored was whether or not the process of concept mapping, which has been shown to be effective in other educational areas, could be applied to aural skills and aural stimuli. Concept mapping is an active learning technique that involves the learner in linking new information with previous knowledge (Berge, 2002; Cooper, 1993; Hyerle, 1995; Jonassen, 1991; Marienau & Fiddler, 2002; Novak, 1993). While this has been successfully used in other areas, it had not been previously applied to aural stimuli. This question, therefore, is central to the goal of developing a better practice method for aural skills. Essentially the question is: can aural stimuli such as a chord or interval be used as the central concept in the same way that ideas, such as Congress or Gypsy Moths, are used to which other, more familiar concepts are linked?

Participants in the treatment group were given examples of concept maps (Appendix C) and brief instructions on how to prepare one. Blank maps (Appendices C3-7) were provided for each chord type (quality). The participant was to fill in as many blanks as they wished while listening to the chord series of that particular chord type. Almost all the participants in the treatment group filled in most, if not all, of the blanks. A few students added additional links. A review of the completed maps showed many similarities in the descriptions of each chord type, and several had unique descriptions.

Most of the comments used emotions such as, happy, sad, nervous, or confused. For example, one student described the major chord as "Makes me feel happy, sounds majestic, reminds me of church." Another described the augmented chord as "suspenseful, grating, like the sound of impending doom." Some mentioned examples such as "Scooby Doo," or a "trumpet fanfare." Others described that certain chords sounded like "nails on a chalkboard" or a "train horn." Two students seemed to have trouble making unique descriptions for each chord type. A review of their test results showed either no change between the pre- and posttest or a decline. This might indicate that their inability to make meaningful connections was reflected in their ability to recognize the chord types. Overall, the participants had no trouble making connections to the aural stimuli.

Of the thirty students who participated in the treatment group, twenty (67%) either improved their score or (in two cases) kept the same score but reduced the time spent on the posttest by as much as 50%. There was a mean gain for the treatment group of $M = 5.33$ as well as an increase in the median of 8 points (two questions). A paired examples t-test (Table 6) showed a significance of $t(29) = 2.088$, $p = .046$ (2-tailed) for the treatment group gain.

These statistical results, along with examination of the prepared concept maps, indicate that it is possible to apply the process of concept mapping to aural skills. It also appears that aural stimuli can be used in the same way a verbal concept is used, that is, as the central concept to which other concepts and descriptions are linked. This concurs with present teaching practice and recent research (Cuddy & Upitis, 1992; Foulkes-Levy, 1996). Based on the findings from this study, we can conclude that the answer to the first research question is yes, the process of concept mapping can be applied to aural stimuli.

5.3. RESEARCH QUESTION 2

The second research question reflected on attempts to measure how effective concept mapping can be when applied to recognition of aural stimuli. The answer to this question is more complex and the findings from the experiment were moderately positive. The experiment in this study used chords as the aural stimulus. Chords were chosen because of their sonic richness allowing for a variety of descriptions and connections to the listener's prior experience. This was evidenced by the quality of the concept maps prepared by participants in the treatment group.

Participants were given a pretest of twenty-five (25) chords randomly chosen from a pool of fifty (50). Following the lesson they took a posttest of another twenty-five chords randomly chosen from the same pool of fifty. The analysis of these tests, presented in the previous chapter, showed that the results were not statistically significant. Although the gain score for the treatment group, $M = 5.33$, was higher than that for the control group, $M = 1.25$, the Analysis of Covariance (ANCOVA) did not show any statistically significant difference between the two groups. The moderately significant gain ($p = .046$) for the treatment group shown above becomes non-significant ($p = .060$) when the pretest scores are adjusted for baseline equivalency. However, because the alternative hypothesis in this experiment was to determine if there was an increase in the posttest scores due to the treatment, the results could be viewed as a one-tailed test and not two-tailed as shown in the analysis. The results then would show a significance of $p = .030$.

It is evident from the analysis of the test results that participants in the treatment group improved on the posttest. This is clear from both the greater gain for the mean scores as well as a higher median score on the posttest for the treatment group. Analysis of the gain shows that the treatment group median went up (8 points) while the control group median did not change. However, statistical analysis between the two groups showed only moderate significance.

There are several factors that might have contributed to these results. First, the sample size is relatively small ($n = 62$). This was a sample of convenience chosen from the students enrolled in four sections of the aural skills class. Because of size of the sample group, the investigator measured the effect size of the results to determine if sample size had a bearing on the results. Effect size, which is most often used in meta-analysis (Coe, 2000) separates the sample size from the analysis and can give a more accurate indication of the actual effect of the treatment on the test subject. A calculation of Cohen's *d* score (Baker, 1998) which compares the means and standard deviations of both groups yielded a result of $d = .198$. In order to equate the baseline, as in the ANCOVA above, this calculation used a standard deviation value pooled from both groups. The interpretation of this analysis indicates a moderate increase for the control group. Based on standardized percentiles, a posttest score in the 50th percentile range in the treatment group would be in the 58th percentile range of the control group. While this is not a large change, it is another indication that the treatment had a positive effect on the participant's ability to recognize chord types in the posttest.

Another factor that might have contributed to the moderate statistical significance might have been the methodology of the experiment. This study was conducted as a single-session experiment. The participants came to the computer laboratory during a regular class period. After logging in to WebCT, they were given the pretest, lesson and posttest in that time period. While the exact time each participant spent on the entire experiment was not recorded (WebCT only records the time the student logged in, and the time taken for each test) the investigator observed a range of approximately 20 to 50 minutes with the average student spending around 30 minutes on the experiment.

Because this experiment was done in one session with the pretest and posttest being the same except for exact content, some students might have rushed through the posttest without paying much attention to what they were doing. While taking less time on the posttest could be an indication of a positive treatment effect, it could also contribute to a lower posttest score in both the treatment and control groups. An analysis of Time versus Gain (Figure 10) graphically illustrates this phenomenon. The majority (18) participants in the treatment group improved their posttest scores. Of those, half (9) also took less time on the posttest. Two students scored the same on the posttest as on the pretest, but did it in less time. One student took 9:01 minutes on the pretest and only 3:58 minutes on the posttest. The other spent 7:24 minutes on the pretest and 4:25 minutes on the posttest. In both cases this reduction in time might be attributed to a positive effect of the treatment. The remaining nine participants in the treatment group spent less time on the posttest and also scored lower than on the pretest.

Of the 32 participants in the control group, 13 had improved posttest scores, 14 had lower scores while 5 had no change. The majority of these students (26) spent less time on the posttest than on the pretest. Of the six who took more time, 3 improved their pretest score, 2 went down and one stayed the same. Overall, participants in the control group spent less time on the posttest and either had no change in their pretest-posttest score, or went down. For the 9 students who increased their score in less time, the best explanation is the carry over effect from having done the pretest so soon before taking the posttest. The control group students also heard the chords play three times (same as for the treatment group) but their task did not involve thinking about the chords. Nevertheless, they were exposed to the chords directly prior to taking the posttest.

The answer to the second research question, then, is inconclusive. Although there are indications of a positive treatment effect, the results are just not strong enough to conclude that the results were not just due to chance. The results do suggest that the process of concept mapping can improve recognition of aural stimuli in the form of chords. However, further testing that would control for the issues mentioned above is needed to ascertain if this is indeed true.

5.4. RESEARCH QUESTION 3

The third and final leg of this triangle is, perhaps, the easiest to address. Because the overall goal was to find a more effective and efficient way to practice aural skills, computer mediation is an obvious tool to use. The personal computer, which is now almost ubiquitous on college campuses, offers the easiest way to personalize practice. The personal computer, from almost its inception, has been used in aural skills training and practice. Although the sounds and graphics were primitive, educators early on recognized the ability of the personal computer to deliver a variety of content that could be individualized for the student.

The information and materials for this experiment were delivered using a combination of printed material and computer mediation. The computer was used to deliver the two tests and guide the participant through the lesson. All the chords were produced digitally on the individual computer using high quality sounds. Because the goal of the experiment was to determine the effect of active involvement, the participants were asked to write their thoughts and descriptions on paper while listening to the chords presented by the computer. By using two separate activity modes, writing and listening, the participant was involved more deeply in the task (Craik & Lockhart, 1972; Paivio, 1978).

For this study, the computer was also used to collect data from the tests. In order to do this, an e-learning environment, WebCT, was used. All the materials presented by the computer were prepared using html, a programming language that is widely used to present information via a web browser. Web browsers, which are now a commonplace part of the basic computer interface, can be used to access html files from a variety of media such as a web server, floppy disk, or CD ROM. The only requirement for successful delivery of this information would be a recent model computer and operating system. Older computer systems might not have the same capability to produce high quality sounds, which could possibly reduce the effectiveness of the delivery.

There was no indication in any part of this experiment that the computer was a hindrance. All the participants were familiar with the medium and had no trouble accessing the information. Furthermore, there are a number of software applications currently available that create and edit html documents as easily as using a word processor. This allows for relatively easy production of materials for computer delivery. The answer to the third research question is that, given the state of current technology, it is possible to mediate the process of concept mapping via a personal computer. Although there was no comparison in this study to other delivery methods, all indications were that computer mediation was successful.

5.5. IMPLICATIONS FOR FURTHER RESEARCH

Overall, the results of this study indicate that the process of concept mapping can be applied to aural skills training and practice. Due to the limitations of the present study, further study of this process is needed to determine if indeed this will be useful for improving aural skills practice. Of particular interest would be a study similar to the present one, but over a longer period of time. Participants would be given a pretest to establish baseline equivalency and then separated into groups. One group would use concept mapping as a practice tool and the other would have access to the other tools presently used. This study should cover at least one unit of study in the normal class schedule and occur over the same time period normally spent on that unit. Both groups would receive a posttest similar to the pretest and the results would be compared. The main issue here would be the effect of the treatment over a longer period of time and in a more realistic context. This would also eliminate the carry over effect of the pretest on the posttest that might have occurred in the present study.

Another area of research that might be needed to determine the best method of practice is one that would address the individual learning style of the student. Both the present study and the one suggested above do not address the issue of why some students make no sense of the material at all. Constraints such as field dependence/independence (Fullerton, 2000) and learning style (Myers, 1992) might affect the success of concept mapping for some students. Gordon (1971) and Gardner (1983) address the issue of individualization in regard to music learning and aptitude. Both of these areas might need to be considered in future experiments on the effectiveness of concept mapping as a method of practice in aural skills. Because individualization is important for effective practice, student characteristics should be taken into consideration.

A further issue that should also be addressed, especially when designing practice exercises using concept mapping is to include instruction and practice in the technique of concept mapping. The present study only included a simple explanation of concept mapping and a few examples. For students to make better use of this method of study, more instruction and examples are needed. This will allow the researcher to see more clearly the effectiveness of the practice method without it being hampered by the student's lack of knowledge of the technique.

5.6. SUMMARY

Aural skill training is central to the development of the musician. As such it should receive the best of what is known about cognition and learning. While this could occur in the classroom, practice materials that are available seem to be based on methods that have been shown by recent research to have limited effectiveness. Computer mediated materials, which have been used for over a quarter of a century, are essentially the same as when they were first developed. The only difference is in the package and presentation. Computer systems are now capable of very high quality graphics and sounds and programming techniques allow for a high degree of sophistication in the organization and delivery of these materials (graphics and sounds). However, the pedagogical technique is still based on drill and practice, a useful technique, but one with limited success and effectiveness. This fact is corroborated by research (Fletcher-Flinn & Gravatt, 1995; Karpinski, 2000; Ozeas, 1991) as well as by the experience of this investigator and others who teach these courses. In general, computer assisted practice tools have shown limited effectiveness in helping the student reinforce what is learned in the classroom.

This study was an endeavor to explore a better way to practice aural skills, a way that would utilize the tools such as the computer, as well as one that would take advantage of the research in effective educational practice. Educators generally agree that when the student is actively involved in the learning process, they learn better and retain more (Cooper, 1993; Driscoll, 2002). While this can be and is being done in the classroom, practice materials and especially computer assisted practice materials do not appear to use this paradigm. One technique that has been used extensively in science and mathematics is concept mapping. Concept mapping actively involves the student in the material.

This technique was applied to aural skill practice in this study and adapted to computer mediation. The overall outcome indicated that this process could be used to improve the practice materials. It also demonstrated that these materials could easily be developed for and delivered by the computer. While further research is needed to determine the effectiveness of the technique, concept mapping should be seriously considered as the basis for a new, more efficient and more effective method for practicing aural skills.

APPENDIX A

A1 Informed Consent form

A2 Voluntary Consent Form

A1 Informed Consent Form

You are invited to participate in this research study. The following information is provided in order to help you to make an informed decision whether or not to participate. If you have any questions please do not hesitate to ask. You are eligible to participate because you are enrolled in MUSC 111 at Indiana University of Pennsylvania.

The purpose of this study is to test a new way of practicing chord quality identification. This process has not been studied in this way before. There are no known risks or discomforts associated with this study.

You will be randomly assigned (like the flip of a coin) to either the treatment group or to the control group. Both groups will take a pretest to identify the quality of twenty-five chords chosen at random from a pool of fifty. Following the pretest each group will be given a lesson which will be followed by another test of twenty-five chords chosen at random from the same pool of fifty. Your scores will be saved and statistically analyzed to determine if the treatment had any effect on your ability to recognize the chords in the posttest. All your scores will be completely anonymous and only group data will be reported in the findings.

Your participation in this study is completely voluntary. If you choose not to participate, it will have no effect on your grade in this class. Participation will occur in the CFA Computer Lab in Sprowls Hall during one class session. The study is designed to be completed in one period. Those who choose not to participate will have a study session with their instructor during the same period.

If you are willing to participate in this study, please sign the statement below and give it to your class instructor. Take the extra unsigned copy with you. If you choose not to participate, give both to the instructor.

Project Director: John Scandrett
Associate Professor of Music
Indiana University of Pennsylvania
404 Gordon Hall
Indiana, PA 15705
jscandt@iup.edu
724-357-4814

This project is being done as part of the researcher's doctoral work at the University of Pittsburgh, School of Education, Department of Instruction & Learning, Dr. Louis Berry, Associate Professor, advisor, 5A21 W. Posvar Hall, University of Pittsburgh, Pittsburgh, PA 15260, 412-624-7229.

This project has been approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects (Phone: 724-357-7730).

A2 Voluntary Consent Form

VOLUNTARY CONSENT FORM

I have read and understand the information on the form and I consent to volunteer to be a subject in this study. I understand that my responses are completely confidential and that I have the right to withdraw at any time. I have received an unsigned copy of this informed Consent Form to keep in my possession.

Name (PLEASE PRINT) ____

Signature ____

Date ____

I certify that I have explained to the above individual the nature and purpose, the potential benefits, and possible risks associated with participating in this research study, have answered any questions that have been raised, and have witnessed the above signature.

___________________ ____

Date Investigator's Signature

APPENDIX B

MATERIALS ON WEBCT "AURAL SKILLS RESEARCH PROJECT"

B1 Chord Pool

B2 Aural Skills Research Project (ASRP) WebCT Home Page

B3 ASRP Introduction Page

B4 ASRP Experimental Treatment Lesson Page

B5 ASRP Experimental Treatment Chord Play Page

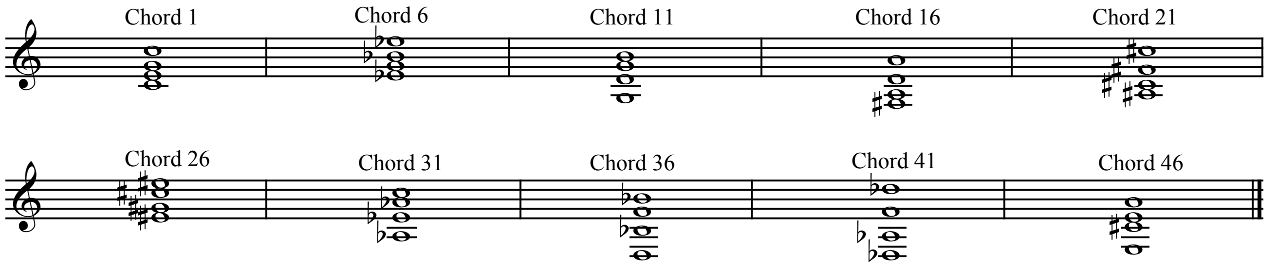
B6 ASRP Control Group Lesson Page

B7 ASRP Control Group Chord Play Page

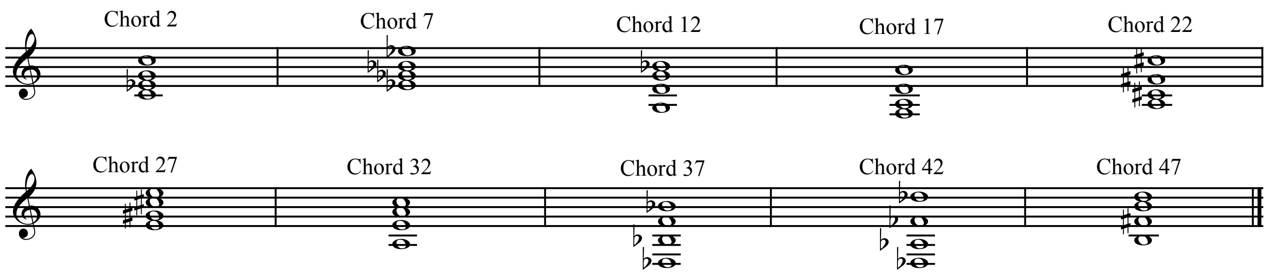
B8 ASRP Control Group Final Chord Play Page

B1 Chord Pool

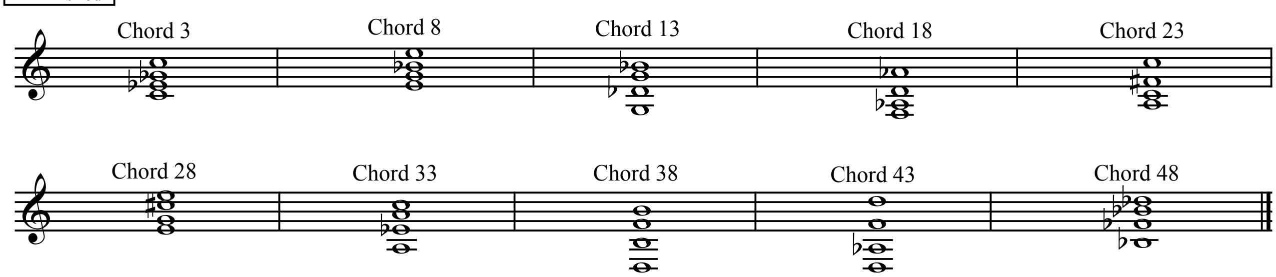
Major



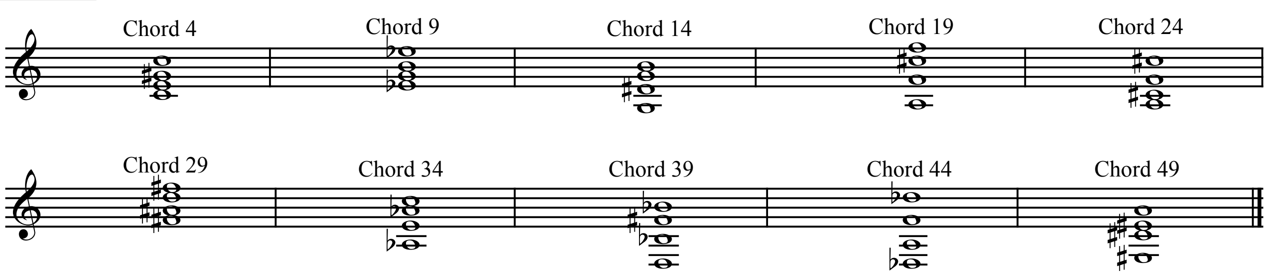
Minor



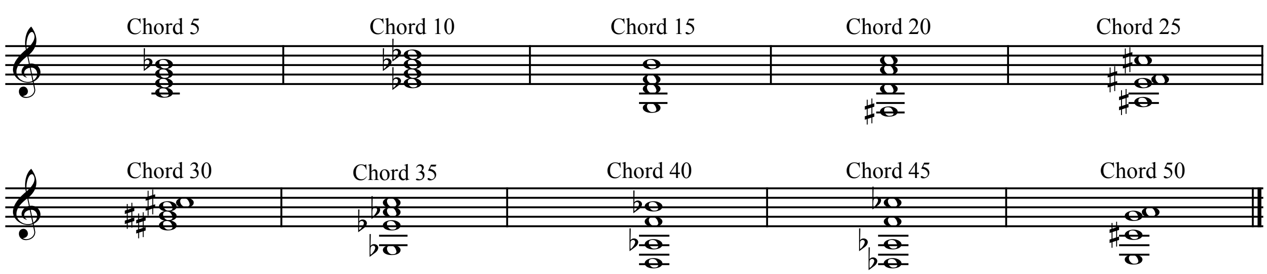
Diminished



Augmented



Dominant 7th



B2 ASRP Home Page

B3 ASRP Introduction Page

Aural Skills Research Project

Introduction

The project consists of three parts:

1. Pretest - to assess your basic level of chord recognition
2. Lesson - the technique being studied
3. Posttest - to assess any change

Your scores on the pretest and posttest are confidential and all results will be anonymous.

Procedure

1. Select **Tests** from the **Course Menu** and choose **Pretest** in the Tests menu.

   > Follow the directions for taking the test.
   > When you are done press **Finish** to save your scores.
2. Select **Lesson** from the **Course Menu.**
3. Select **Tests** again from the **Course Menu** and choose **Posttest** in the Tests menu.

Click "Tests" in the Course Menu to continue

B4 ASRP Experimental Treatment Page

Aural Skills Research Project

Concept Mapping

Concept Mapping (CM) is a process where main ideas or " concepts" are linked with other ideas or concepts to make a "proposition" or description of that idea. Because you create this yourself, using your own words and thoughts about the main idea, your understanding of that idea or concept will be better than simply memorizing facts or definitions.

Procedure

1. Open your envelope and take out the chord maps and example sheet.
2. Choose one of the chord types below. You may listen to the chords three (3) times.
3. After the first time you listen to the chords, write your thoughts and descriptions on the concept map for that chord type.
4. Play the chords again and make any changes or additions you think are needed.
5. Play the chords a third (and final) time, checking that what you have accurately describes what you heard.
6. Repeat this procedure for each chord type.
7. Save your completed maps, put them back into the envelope and turn them in to the researcher.
8. When you have finished all the chord types, click "Tests" in the Course menu to continue.

Major Chords
Minor Chords
Diminished Chords
Augmented Chords
Dominant 7th Chords

Click "Tests" in the Course Menu to continue

To help you understand more about CM, the links below are sites with good explanations of the Concept Mapping process.

Inspiration and Concept Maps - The Virtual Institute

Semantic Networks

B5 ASRP Experimental Treatment Chord Play Page

Aural Skills Research Project

Concept Mapping

Major Chords

1. Listen to the chords as they play.
2. Fill in the boxes on the Concept map with your thoughts and descriptions of what you hear.
3. Click on the "Play Again" button.
4. Check what you have written and change or add more as you wish.
5. Click on the "Play Again" button.
6. Check that what you have written accurately describes your perception of this type of chord.

This is the *1st* play

Play Again

B6 ASRP Control Group Lesson Page

Aural Skills Research Project

Chord Identification

For this lesson, you will listen to each of the five types of chords; major, minor, diminished, augmented, and dominant 7th while completing a worksheet on chord identification and musical terms.

Procedure

1. Open your envelope and take out the chord worksheets.
2. Choose one of the chord types below.
3. Each chord group will be played three (3) times.
4. Complete the chord worksheets while listening to the chord groups play.
5. Repeat this procedure for each chord type.
6. Save your completed worksheets, put them back into the envelope and turn them in to the researcher.
7. When you have finished listening to each of the chord types, click "Tests" in the Course menu to continue.

Major Chords
Minor Chords
Diminished Chords
Augmented Chords
Dominant 7th Chords

Click "Tests" in the Course Menu to continue

B7 ASRP Control Group Chord Play Page

Aural Skills Research Project

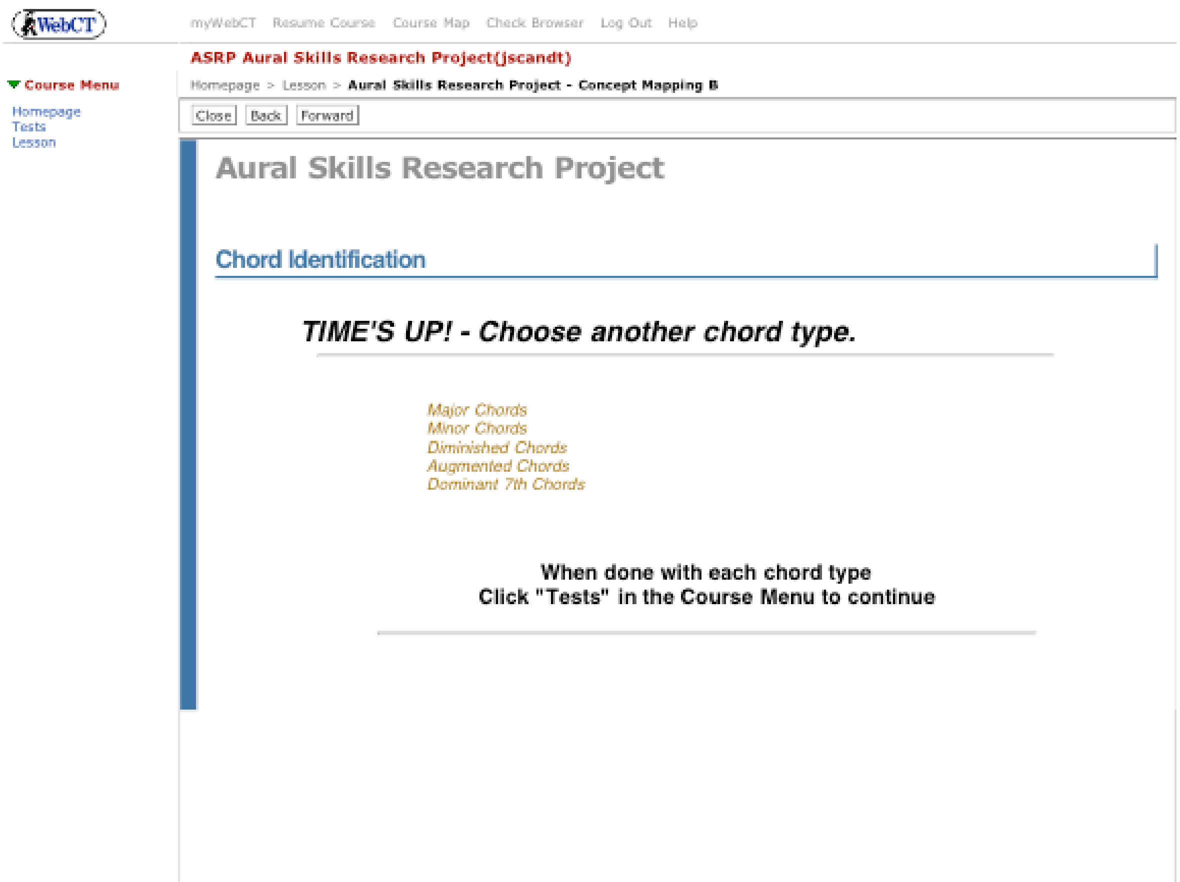
Chord Identification

Major Chords

1. Listen to the chords as they play.
2. Follow the instructions on the worksheet.
3. The chords will play 3 times.

This is the *1st* play

B8 ASRP Control Group Final Chord Play Page



APPENDIX C

MATERIALS IN PARTICIPANT PACKETS

C1 Concept Mapping (Treatment Group)

C2 Making a Concept Map

C3 Major Chord Template

C4 Minor Chord Template

C5 Diminished Chord Template

C6 Augmented Chord Template

C7 Dominant 7th Chord Template

C8 Chord Identification and Musical Terms Lesson (Control Group)

C9 Chord Worksheet 1 - Major

C10 Chord Worksheet 2 - Minor

C11 Chord Worksheet 3 - Diminished

C12 Chord Worksheet 4 - Augmented

C13 Chord Worksheet 5 – Dominant 7th

C1 Concept Mapping

Concept Mapping is a tool used to describe a central concept. Examples and explanations are linked with other concepts that illustrate and illuminate the central concept. What is most important, is that you attach items to the central concept that make sense to you as well as to the central concept.

Attached are blank Concept maps for each of the chord types you heard in the pre-test; major, minor, diminished, augmented, and dominant 7^{th}. The chord name is the central concept to which the other ideas are attached. Every chord type has a unique and distinctive sound. As you listen to each group of chords, write down your descriptions or thoughts about those chords.

In describing these chord types, you can use anything that helps you express what is unique about this particular chord. For example, you could use emotions such as

- Happy
- Sad
- Excited
- Scared
- Nervous
- Relaxed

Some have used colors to describe a sound. Others have used popular songs, TV shows or movies that could be associated with a particular chord sound. As long as it makes sense to you, and describes what you hear, then write it down.

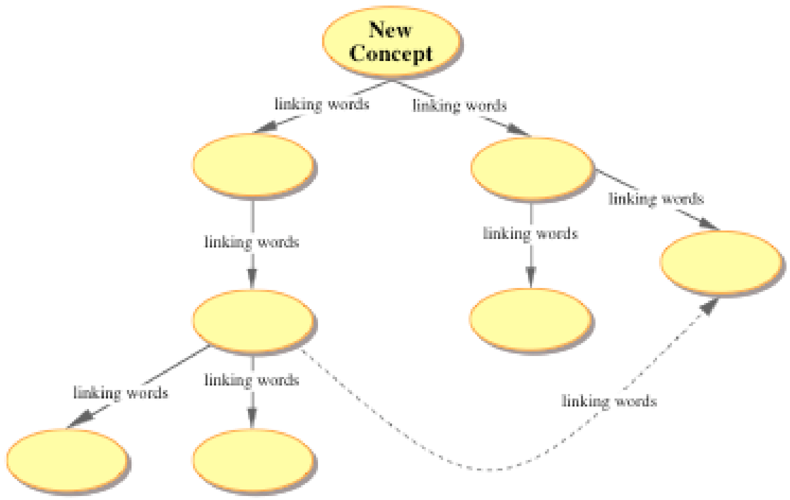
Each of these thoughts and descriptions can also be linked with words or phrases such as:

- Sounds like
- Makes me feel
- Reminds me of
- Often used as
- Often used in

You are not limited to these items. They are merely given as an example for you to help you get started. You are to listen to each chord group three times while completing the attached chord concept maps. When you are finished, put everything back in the envelope and return it to the researcher.

Thank you for being part of this study.

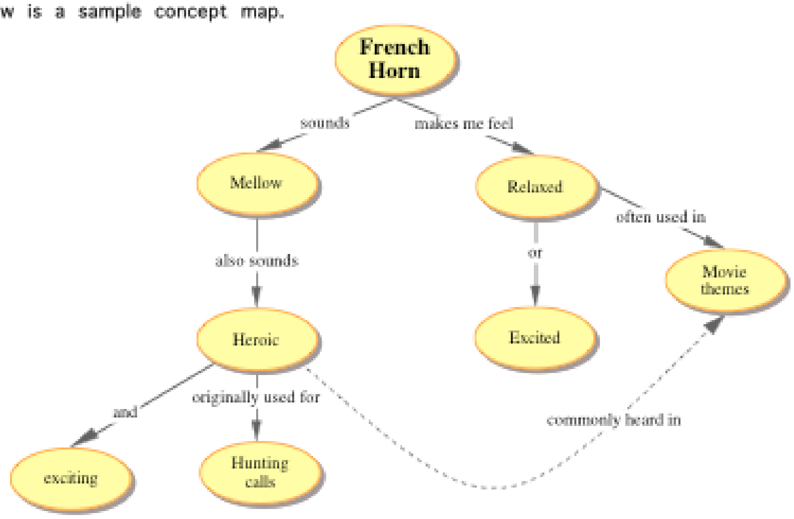
C2 Making a Concept Map



Benefits of using the Concept Map template
Concept maps show relationships between ideas. They are used in any discipline to help analyze information, chains of events, systems, subsystems, and so forth. Concept maps connect symbols with syntax so meaning can be constructed, understood, and remembered, both visually and verbally.

How to use this template
1. The main idea is placed in the symbol labeled "New Concept."
2. Add your thoughts and ideas about that Main Idea in the other boxes.
3. Use linking arrows to connect related concepts.
4. In each link's associated text box, enter words that explain the connections between the ideas.
5. Add any additional boxes and links you feel are needed.

Below is a sample concept map.



C3 Concept Maps - Major

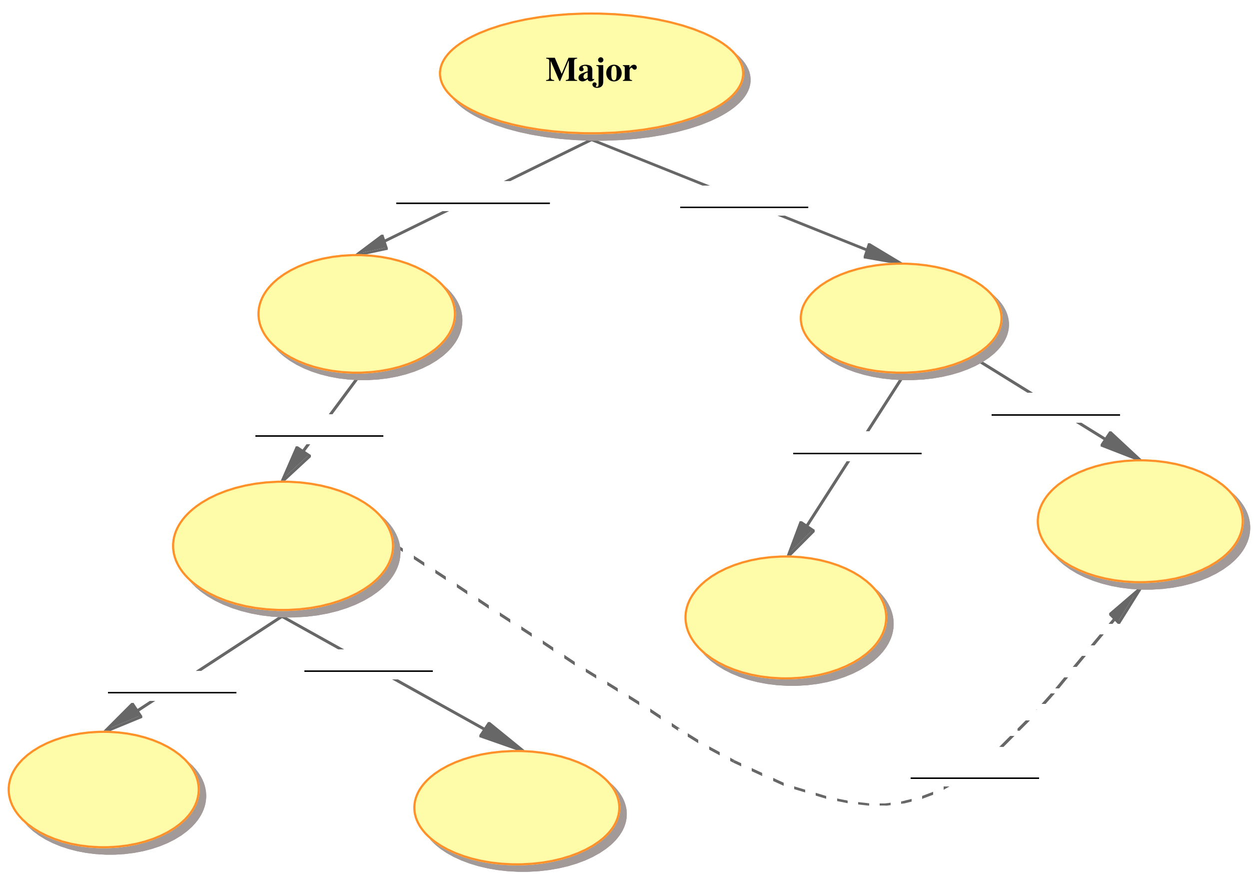
Below is a blank concept map template.

1. **Listen to the chords**.
   a. Write your thoughts and descriptions of what you hear in the boxes.
   b. Link those thoughts and descriptions with some sort of connecting word or phrase.

(You are not limited to the boxes and links below nor do you have to fill in all of them.)

2. **Listen to the chords again**.
   a. Add new thoughts and links about the chords you hear.

3. **Listen to the chords once again**
   a. Check that what you have written accurately describes what you hear.



C4 Concept Maps - Minor

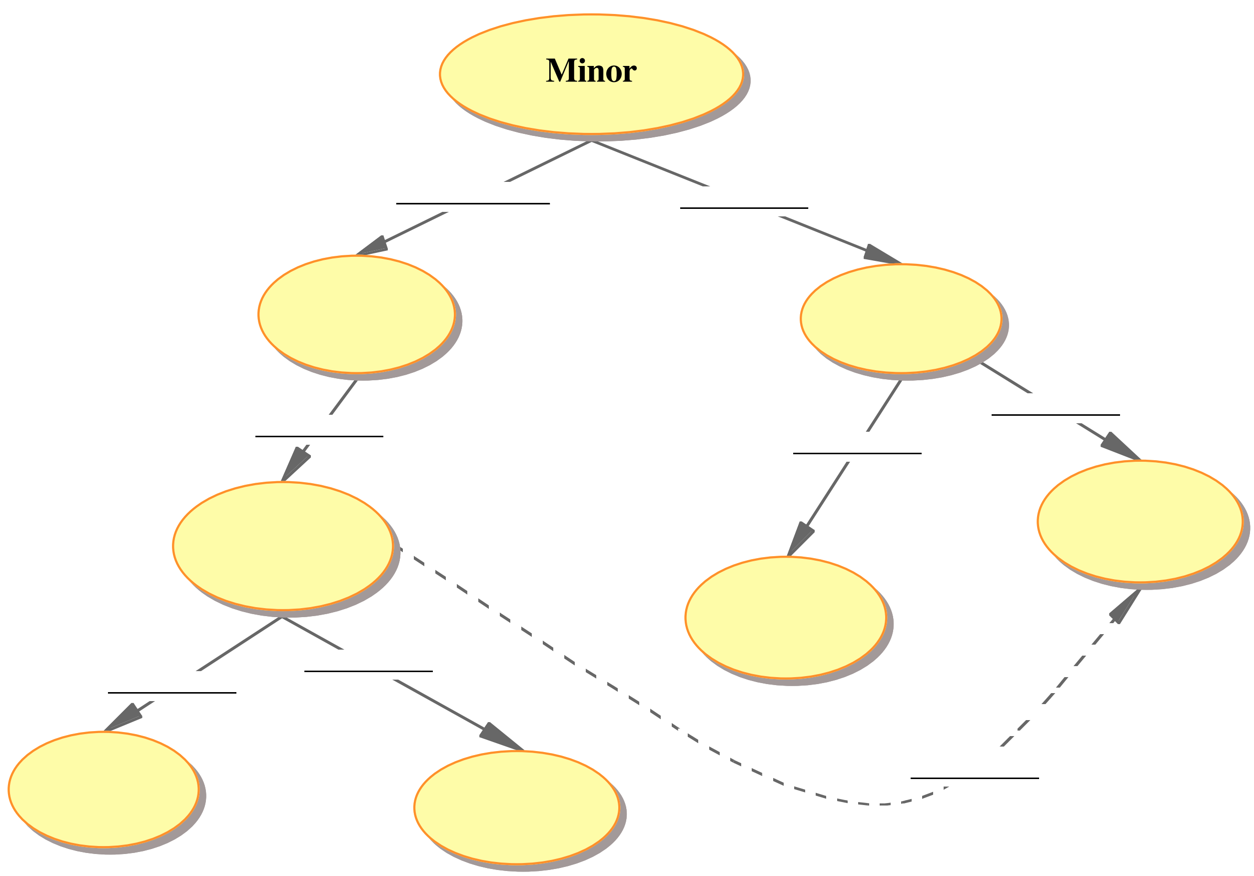
Below is a blank concept map template.

4. **Listen to the chords**.
    a. Write your thoughts and descriptions of what you hear in the boxes.
    b. Link those thoughts and descriptions with some sort of connecting word or phrase.

(You are not limited to the boxes and links below nor do you have to fill in all of them.)

5. **Listen to the chords again**.
    a. Add new thoughts and links about the chords you hear.

6. **Listen to the chords once again**
    a. Check that what you have written accurately describes what you hear.



C5 Concept Maps - Diminished

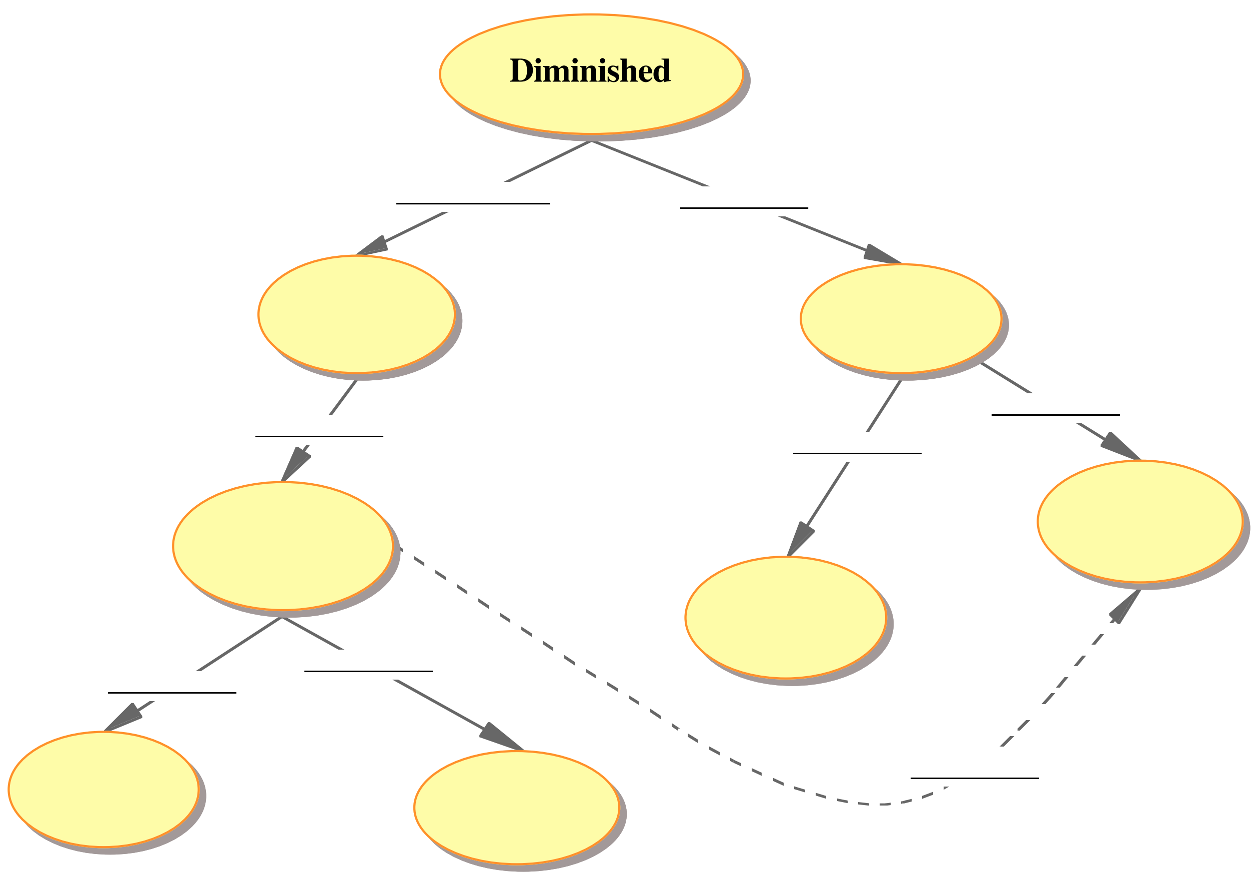
Below is a blank concept map template.

7. **Listen to the chords**.
   a. Write your thoughts and descriptions of what you hear in the boxes.
   b. Link those thoughts and descriptions with some sort of connecting word or phrase.

(You are not limited to the boxes and links below nor do you have to fill in all of them.)

8. **Listen to the chords again**.
   a. Add new thoughts and links about the chords you hear.

9. **Listen to the chords once again**
   a. Check that what you have written accurately describes what you hear.



C6 Concept Maps - Augmented

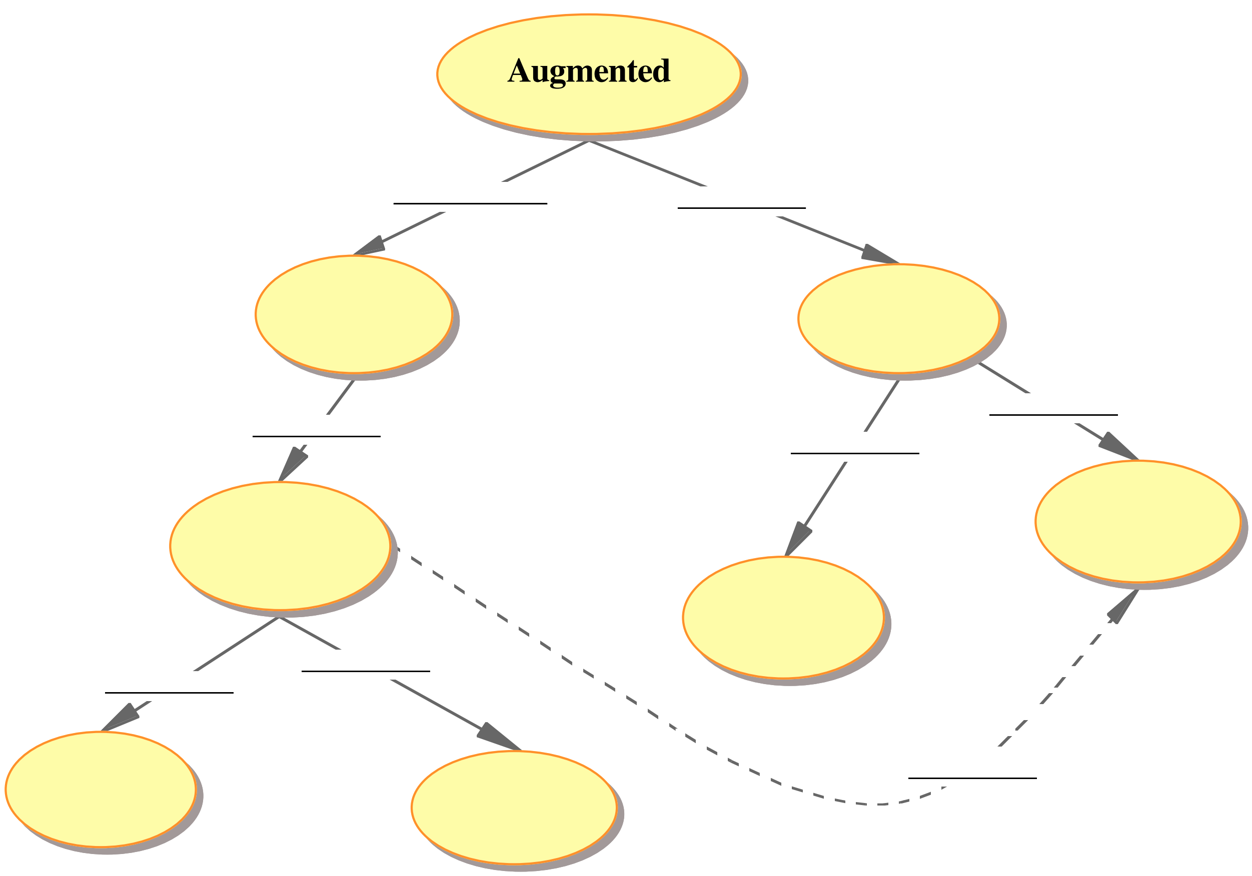
Below is a blank concept map template.

10. **Listen to the chords**.
    a. Write your thoughts and descriptions of what you hear in the boxes.
    b. Link those thoughts and descriptions with some sort of connecting word or phrase.

(You are not limited to the boxes and links below nor do you have to fill in all of them.)

11. **Listen to the chords again**.
    a. Add new thoughts and links about the chords you hear.

12. **Listen to the chords once again**
    a. Check that what you have written accurately describes what you hear.



C7 Concept Maps – Dominant 7th

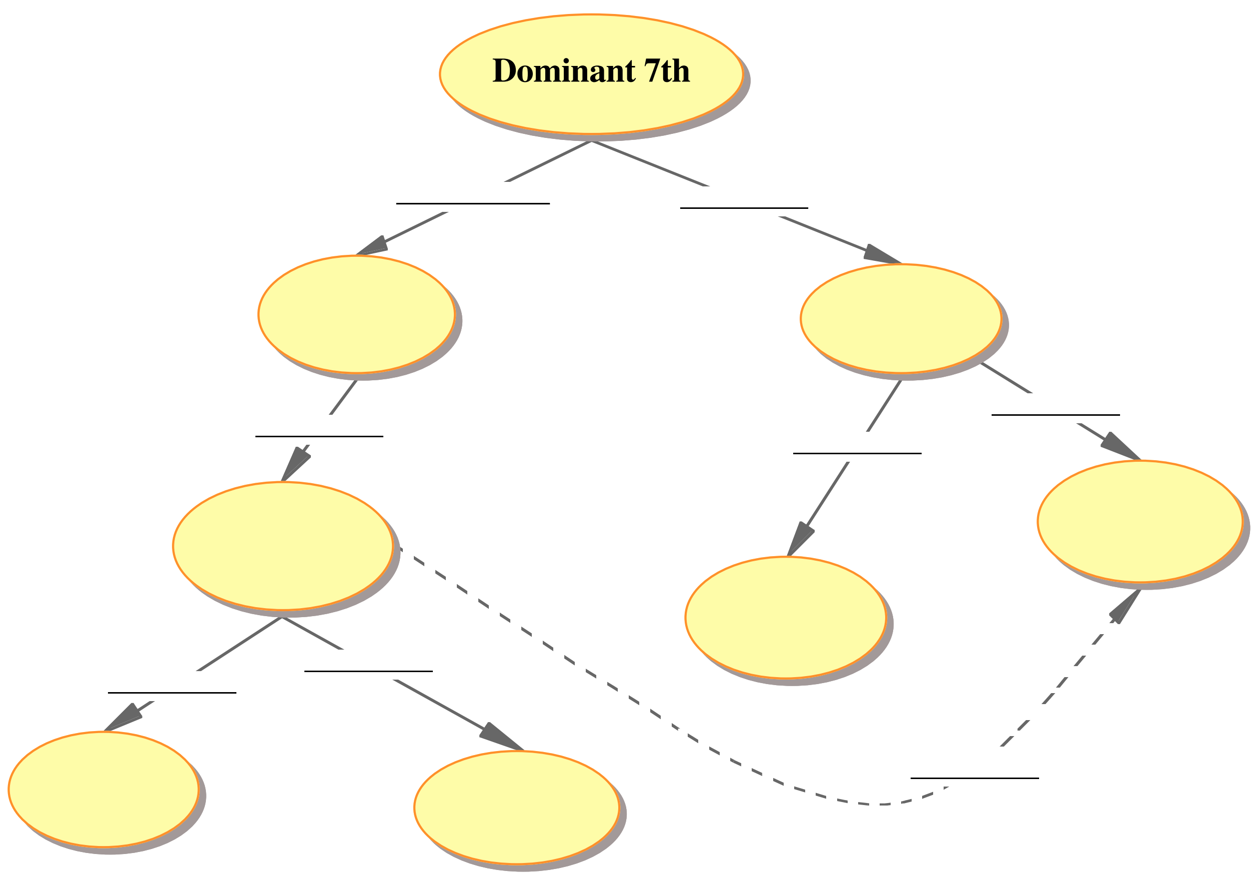
Below is a blank concept map template.

13. **Listen to the chords**.
    a. Write your thoughts and descriptions of what you hear in the boxes.
    b. Link those thoughts and descriptions with some sort of connecting word or phrase.

(You are not limited to the boxes and links below nor do you have to fill in all of them.)

14. **Listen to the chords again**.
    a. Add new thoughts and links about the chords you hear.

15. **Listen to the chords once again**
    a. Check that what you have written accurately describes what you hear.



C8 Control Group

AURAL SKILLS RESEARCH PROJECT

CHORD IDENTIFICATION AND MUSICAL TERMS LESSON

- Your task in this lesson is to listen to each of the five types of chords that you heard in the pre-test: major, minor, diminished, augmented, and dominant 7^{th}. While you listen to the chords, you are to solve the following musical term and chord identification anagrams.

- There is one worksheet with two anagrams for each chord type.

- When you choose a chord type, a set of chords of that type will automatically play three times. There will be time between each playing for you to work on the anagrams. Do not worry if you do not finish each anagram. Do what you can.

- Save your completed (or partially completed) worksheets and put them back in the envelope to be returned to the researcher.

- When you have listened to each of the chord types, click ***"Tests"*** in Course Menu to continue.

C9 Worksheet 1 - Major

Below are two anagrams to unscramble. One is a type of chord, the other is a musical term relating to this class.

"A TORRID JAM"

M	A	J	O	R		T	R	I	A	D

"SKULL AS LIAR"

A	U	R	A	L		S	K	I	L	L	S

C10 Worksheet 2 - Minor

Below are two anagrams to unscramble. One is a type of chord, the other is a musical term relating to this class.

"I DISDAINED MIRTH"

D	I	M	I	N	I	S	H	E	D		T	R	I	A	D

"IN RARE GIANT"

E	A	R		T	R	A	I	N	I	N	G

C11 Worksheet 3 - Diminished

Below are two anagrams to unscramble. One is a type of chord, the other is a musical term relating to this class.

"GOOF LIES"

S	O	L	F	E	G	I	O

"HAD ON INVESTMENT"

D	O	M	I	N	A	N	T

S	E	V	E	N	T	H

C12 Worksheet 4 - Augmented

Below are two anagrams to unscramble. One is a type of chord, the other is a musical term relating to this class.

"TRIM SO DRAIN"

M	I	N	O	R		T	R	I	A	D	S

"NIGHT SIN GIGS"

S	I	G	H	T		S	I	N	G	I	N	G

C13 Worksheet 5 – Dominant 7th

Below are two anagrams to unscramble. One is a type of chord, the other is a musical term relating to this class.

"SEE FLOG"

S	O	L	F	E	G	E

"MUTTERING AS DEAD"

A	U	G	M	E	N	T	E	D

T	R	I	A	D	S

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