INFORMATION TO USERS

While the most advanced technology has been used to photograph and reproduce this manuscript, the quality of the reproduction is heavily dependent upon the quality of the material submitted. For example:

- Manuscript pages may have indistinct print. In such cases, the best available copy has been filmed.

- Manuscripts may not always be complete. In such cases, a note will indicate that it is not possible to obtain missing pages.

- Copyrighted material may have been removed from the manuscript. In such cases, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, and charts) are photographed by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each oversize page is also filmed as one exposure and is available, for an additional charge, as a standard 35mm slide or as a 17" x 23" black and white photographic print.

Most photographs reproduce acceptably on positive microfilm or microfiche but lack the clarity on xerographic copies made from the microfilm. For an additional charge, 35mm slides of 6" x 9" black and white photographic prints are available for any photographs or illustrations that cannot be reproduced satisfactorily by xerography.
Whiston, Sandra Kristine

THE DEVELOPMENT OF MELODIC CONCEPTS IN ELEMENTARY SCHOOL AGE CHILDREN USING COMPUTER-ASSISTED INSTRUCTION AS A SUPPLEMENTAL TOOL

The Ohio State University

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106

Ph.D. 1986
PLEASE NOTE:

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark ✓.

1. Glossy photographs or pages _____
2. Colored illustrations, paper or print ______
3. Photographs with dark background ____
4. Illustrations are poor copy ______
5. Pages with black marks, not original copy ______
6. Print shows through as there is text on both sides of page ______
7. Indistinct, broken or small print on several pages ✓
8. Print exceeds margin requirements ______
9. Tightly bound copy with print lost in spine ______
10. Computer printout pages with indistinct print ______
11. Page(s) _______lacking when material received, and not available from school or author.
12. Page(s) ________ seem to be missing in numbering only as text follows.
13. Two pages numbered ______. Text follows.
14. Curling and wrinkled pages ______
15. Dissertation contains pages with print at a slant, filmed as received ______
16. Other _______________________________________________________
   _______________________________________________________
   _______________________________________________________
THE DEVELOPMENT OF MELODIC CONCEPTS IN ELEMENTARY
SCHOOL AGE CHILDREN USING COMPUTER-ASSISTED
INSTRUCTION AS A SUPPLEMENTAL TOOL

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Sandra Kristine Whiston, B.M., M.A.

* * * * *

The Ohio State University
1986

Reading Committee:
Ann Blombach
A. Peter Costanza
Judith Delzell

Approved By

A. Peter Costanza
Adviser
School of Music
ACKNOWLEDGMENTS

The author wishes to express her appreciation to her advisor, Dr. A. Peter Costanza for his guidance, support, and assistance during her years of study and association with The Ohio State University and particularly in the course of this dissertation. Appreciation is also extended to the other members of the author's committee, Dr. Ann Blombach and Dr. Judith Delzell for their assistance and critical insight.

Acknowledgment and appreciation are extended to all those persons who assisted in this study, colleagues, as well as, the administrators, teachers, parents, and children from the various elementary schools for their interest and cooperation.

Finally, appreciation is expressed to the author's family whose support, patience, and encouragement made the completion of this document possible.

S.K.W.
VITA

November 17, 1954. . .  Born - Bethlehem, Pennsylvania

1976 ................ B.M. in Music Education,
                   Westminster Choir College,
                   Princeton, New Jersey

1976-1979. . . . . . Graduate Teaching Associate
             Music History Division
             The Ohio State University
             Columbus, Ohio

1979 ................ M.A. in Musicology
                    The Ohio State University
                    Columbus, Ohio

                    Hilliard City Schools
                    Hilliard, Ohio

1984-1985. . . . . . Graduate Teaching Associate
                    Music Education Department
                    The Ohio State University
                    Columbus, Ohio

1985-1986. . . . . . Ph.D. Candidate
                    in Music Education
                    The Ohio State University
                    Columbus, Ohio

1986- . . . . . . . Assistant Professor of
                    Music Education, Elementary
                    University of Nebraska
                    Lincoln, Nebraska

FIELDS OF STUDY

Major Field: Music Education
Studies in Music Education: Dr. A. Peter Costanza,
Dr. Timothy Gerber, Dr. Joan K. Lehr, Dr. Wayne
Ramsey, Professor Mary Tolbert

Studies in Music Theory: Dr. Ann Blombach
Studies in Education: Dr. Robert Bargar

iii
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>VITA</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Purpose</td>
<td>1</td>
</tr>
<tr>
<td>Assumptions</td>
<td>1</td>
</tr>
<tr>
<td>Definitions</td>
<td>1</td>
</tr>
<tr>
<td>Delimitations</td>
<td>1</td>
</tr>
<tr>
<td>Need for the Study</td>
<td>1</td>
</tr>
<tr>
<td>II. REVIEW OF RELATED LITERATURE</td>
<td>12</td>
</tr>
<tr>
<td>III. PROCEDURES</td>
<td>54</td>
</tr>
<tr>
<td>Review of Selected Software</td>
<td>54</td>
</tr>
<tr>
<td>Validation Procedures for Software</td>
<td>54</td>
</tr>
<tr>
<td>Validation Procedures Pretest/Posttest</td>
<td>54</td>
</tr>
<tr>
<td>Pilot Study I</td>
<td>54</td>
</tr>
<tr>
<td>Results and Discussion of Pilot Test I</td>
<td>54</td>
</tr>
<tr>
<td>Pilot Study II</td>
<td>54</td>
</tr>
<tr>
<td>Results and Discussion of Pilot Test II</td>
<td>54</td>
</tr>
<tr>
<td>Main Study</td>
<td>54</td>
</tr>
<tr>
<td>Design of the Study</td>
<td>54</td>
</tr>
<tr>
<td>Treatment Period</td>
<td>54</td>
</tr>
<tr>
<td>IV. ANALYSIS OF DATA</td>
<td>107</td>
</tr>
</tbody>
</table>

iv
V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS  121

Summary of Findings
Conclusions
Recommendations for Further Study

APPENDIXES

A. REQUESTS FOR SOFTWARE ............................................ 126
B. ANSWER SHEETS USED IN PILOT STUDY I .................. 130
C. PILOT STUDY I ............................................................ 135
D. REVISED ANSWER SHEET ............................................... 142
E. PILOT STUDY II ............................................................ 145
F. MUSICAL EXAMPLES PRETEST/POSTTEST .................. 161
G. PARENTAL PERMISSION FORM ......................................... 173
H. PAIRED MATCH - TREATMENT GROUPS ..................... 175
I. BEHAVIORAL OBJECTIVES - REGULAR MUSIC ................ 178
J. BEHAVIORAL OBJECTIVES - CONTROL GROUP ........... 191
K. BEHAVIORAL OBJECTIVES - SPECIAL MUSIC ............ 198
L. SOFTWARE DATA COLLECTION SHEET ..................... 206
M. SUMMARY OF INDIVIDUAL STUDENT CAI DATA .......... 208

LIST OF REFERENCES ..................................................... 243
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Results of Pilot Study I</td>
<td>77</td>
</tr>
<tr>
<td>2. Results of Pilot Study II</td>
<td>82</td>
</tr>
<tr>
<td>3. Music Schedule</td>
<td>89</td>
</tr>
<tr>
<td>4. Pretest/Posttest Scores Group I</td>
<td>108</td>
</tr>
<tr>
<td>5. Pretest/Posttest Scores Group II</td>
<td>109</td>
</tr>
<tr>
<td>6. Pretest/Posttest Scores Group III</td>
<td>111</td>
</tr>
<tr>
<td>7. Means and Standard Deviations - Pre/Post</td>
<td>112</td>
</tr>
<tr>
<td>8. Analysis of Variance</td>
<td>113</td>
</tr>
<tr>
<td>9. Summary of The Magic Musical Balloon Game Data</td>
<td>115</td>
</tr>
<tr>
<td>10. Summary of Toney Listens to Music Data</td>
<td>118</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

Children naturally express an interest in sounds and demonstrate this interest by their experimentation, attention, and time given to playing with and imitating sounds. Musical learning depends upon our perceptions of the musical sounds that we hear. In no other field of learning does the acuity of aural perception play such a paramount role.

Age and ability to discriminate pitches have been found to be positively related with the greatest increase in ability occurring with younger children (Petzold, 1966). Shuter (1968) believes that by age twelve, the critical period for pitch identification may have passed, and in some reported instances, twice as much improvement in pitch discrimination has been found to occur between ages six and nine as between ages nine and nineteen.

Investigators have also explored the relationship between pitch discrimination and tonal memory. In all reported cases, there has been a definite relationship,
with pitch discrimination being dependent upon tonal memory. The apprehension of melodic phrases is also dependent upon tonal memory and improves with age. Research has found that the greatest improvement in tonal memory scores occurs between ages eight and nine (Bentley, 1966; Shuter, 1968). After age nine there is a fairly steady, though less spectacular, increase until age fourteen, at which time a leveling off process seems to occur.

Petzold (1966), during his five-year longitudinal study, investigated the development of auditory perception in the areas of melodic perception, phrase learning, melodic reproduction with varying harmonies and timbres, and rhythmic ability. Petzold's hypothesis that age is a major factor in the development of auditory perceptions was supported, although with limitations. For most tasks, a plateau in auditory perception was reached by the age of eight (third grade), and indications were that the most significant development occurs between the ages of six and seven (first and second grades).

The technological development of the microcomputer has given music researchers a new means with which to
investigate pitch discrimination and tonal memory. There are three main uses of microcomputers in music education: (1) as an instructional tool, (2) as a synthesizer, and (3) as a management tool.

As an instructional tool, the microcomputer can be used for drill and practice sessions, tutorial programs, simulations, instructional games, strategy games, problem solving, and for stimulating creativity. The computer can and does carry on a limited dialogue with the student which is sometimes personalized. When the microcomputer is used as an instructional tool, one of its most useful purposes is the immediate feedback which the computer provides for the student. There are many pre-packaged software programs which a teacher can use for this type of instruction, or he may create his own programs. The structure of each software program, either commercial or teacher-made, can either be very limited or more flexible depending upon the age and learning level of the students involved.

As a synthesizer, the microcomputer allows students to define, combine, and record their own original sounds and create, store, retrieve, edit, play back, improvise over playback, and print musical scores of their own
ideas (alphaSyntauri, MIDI). In this manner students are introduced to problem solving tasks which involve them in the roles of performer, composer, listener and critic.

As a management tool, the microcomputer can be used for: (1) scheduling, (2) attendance, (3) grading, (4) planning, (5) keeping student records, (6) testing, (7) music selection, (8) charting, (9) creating forms, (10) budget control, (11) inventory, (12) uniform control, (13) ordering supplies, (14) filing and cataloging, (15) awards, (16) word processing, (17) preparing student worksheets, puzzles or visuals which require typing and/or graphics, and (18) printing.

As with any instructional mode/media, it is essential to take into account the learning process of students and where they are in their development of specific musical skills, concepts, and attitudes. Above all, the computer should be used to enhance or augment the present music curriculum - not to replace it. Instructional programs should be chosen that are
compatible with the learning process and focus upon the music itself not merely the symbols which represent the music.

Purpose

The purpose of this study was to determine the effect of computer-assisted music instruction, when used as a supplemental tool, on the development of tonal memory skills and the aural perception of melodic movement (up/down/same) with first grade students.

The question addressed in this study was:

1. Can tonal memory/aural perception skills be improved through the use of computer-assisted music instruction?

Assumptions

The following assumptions were made:

1. It is possible to develop a test to measure first-grade students' auditory perception of melodic direction and tonal memory.
2. The students have had an initial experience working on an Apple IIe computer.
Definitions

Hardware: Hardware is the actual physical components of a computer system.

Software: Software is the programs which are recorded on magnetic disks that "tell" the hardware what to do.

Monitor: A piece of equipment which is used for visual display.

Disk: The disk is a round piece of magnetic material which spins inside a 5 1/4 inch protective jacket. The disk is used to store information and programs for use with the computer.

Disk Drive: The disk drive is the mechanical piece of equipment which does the actual reading and writing of the information on the disk.

DAC Board: Digital to Analog Converter. A piece of hardware that generates music or sound effects by converting numbers (digits) to sound waves (analog).

Concept: A musical concept is a clear and complete thought about something that has been acquired through sensory perception (Zimmerman, 1971).

Acronyms such as CBI, CAI and CMI are often used to differentiate between the various roles which microcomputers can play in education.

CBI (Computer-Based Instruction). CBI is a total instructional program delivered by a computer. A large memory capacity is required to store the instructional components, branching, testing, record keeping and
reporting. Therefore, mainframe or minicomputers with major software programs are required. Neither microcomputers, networked microcomputers, nor microcomputers with hard disk drives are capable of handling such massive and complex programs.

CAI (Computer-Assisted Instruction). CAI involves the use of the microcomputer as an instructional tool either in the classroom or in the home. In the classroom, however, the teacher still remains the central figure in the learning process. Rather than being a total program, CAI contributes information which supplements other segments of classroom instruction. CAI includes the use of software programs that are often categorized by such terms as drill and practice, tutorial, simulation, or educational games. However, new directions in software development are blurring the lines between these types of programs, making a neat categorization of software more and more difficult. Among these ideas are outlining programs, simulated
laboratory experiments, computer-controlled laboratory equipment, and programs which draw precisely shaded geometric figures.

Research regarding the effectiveness of CAI in music has been difficult to design and support for three primary reasons. First, it is a relatively new technology that has not had time to accumulate a respected body of research. Second, the microcomputer is a machine which is primarily dependent upon the software that drives it. Third, as a classroom tool, its effectiveness is dependent upon the teacher who uses it.

CMI (Computer-Managed Instruction). CMI involves the use of the computer to help the teacher in the management of instruction. Some describe the computer as a teacher aide in this function. Programs may vary from simple record-keeping to complex programs that test, diagnose and prescribe, and track student progress. Software programs that aid in such tasks as preparing tests and worksheets, scoring tests, and analyzing reading levels are sometimes included in this category.
Delimitations

This study is limited to software programs written for the Apple computers. This decision was based upon the kinds of computers which were available in the local school systems.

Need for the Study

Computer-assisted instruction research in music is a relatively new area as can be evidenced by the small number of studies cited in the next chapter. Many studies have indicated that computer-assisted instruction is effective in drill and practice situations, perhaps even more effective than the traditional classroom approach. Most of these studies used the college music major as their primary target group.

VonFeldt (1971), Robinson (1984), and Dangelo (1985) compared the effectiveness of the traditional classroom teaching approach with a computer-assisted instruction-based approach. These studies used students from grades four through ten as their target group. Their results indicated that there was no significant
difference in learning between those students instructed through regular classroom instruction and those students instructed only through computer-assisted instruction.

Many studies have been done to research the effectiveness of computer-assisted instruction in the elementary school with regard to the other areas of the curriculum. Jamison, Suppes and Wells (1974) stated that elementary school children who received computer-supported drill in math and science generally showed performance gains of one to eight months over children who received only traditional classroom instruction. They also concluded that computer-based teaching, when used as a supplement to regular instruction at the elementary level, improved achievement scores, particularly for disadvantaged students. Visonhaler and Bass (1972) reported that results from ten independent studies showed a substantial advantage for computer-augmented instruction in the elementary school.

Ploger (1983) in a comprehensive review of computer-assisted instruction studies done in the regular elementary classroom strongly states that the results indicate: (1) instructional microcomputing can be a valuable educational tool, (2) affective factors
such as motivation and self-esteem are enhanced through the inclusion of microcomputers in an instructional setting and (3) the use of instructional microcomputing is most effective as an adjunct to traditional instructional methods.

Vaughan (1984) investigated the use of computer-assisted instruction as a supplemental tool in the junior high music classroom. Vaughan’s results suggest that students benefit from computer-assisted instruction in classroom music when music theory is being taught. Vaughan further recommends that an emphasis should be placed on instruction using the computer whenever it is appropriate to curriculum objectives.

To date, there have not been any research studies which combine computer-assisted instruction, when it is used as a supplemental tool, and music in the primary grade school setting. Research does need to be done in this area in order to determine whether or not computer-assisted instruction can be used as an effective supplemental tool in the elementary music classroom.
Chapter II

RELATED LITERATURE

The purpose of this chapter is to survey the literature which relates to computer-assisted instruction in music.

Programmed Instruction in Music

There has been great diversity in music computer-assisted instruction (CAI) since its birth in the 1960's. Many types of computer music instruction have been tried from specific ear training exercises to analysis and composition.

Programmed instruction was the forerunner of computer-assisted instruction. Initially, programmed instruction utilized books and/or tapes which required the student to work through a series of questions designed to reach a specific goal. The answers for this type of instruction were essentially self-checking.

Carlsen (1964) was one of the first music researchers to examine the possible uses of programmed instruction in music education. This study investigated the effects of programmed learning on melodic dictation.
skills. Materials (booklets and tapes) were developed for college music theory students, and the effectiveness of branching and linear programs was tested against traditional classroom instruction. The results indicated: (1) no difference between linear and branching programs, (2) melodic dictation by programmed instruction was more effective than by the traditional teacher-classroom approach, and (3) faster learners benefited the most from programmed instruction. In relation to the traditional classroom, Carlsen states that "in practical application, there is much to indicate that programmed instruction's greatest efficiency will be found only when it is not restricted to being the sole educative source in a given discipline" (p. 147). Furthermore, the "potential of programmed instruction for music, particularly aural perception, appears to be great" (p. 148).

In an earlier study by Spohn (1959), program materials were used for structured outside preparation of melodic comprehension skills. The experimental group (structured) used tape recorded materials and self-presentation. The students then self-checked their answers against a correct answer on the tape. Results
revealed that the structured approach to outside class preparation using programmed tapes significantly decreased errors in aural melodic comprehension. Spohn (1963) observed three problems with the traditional music classroom: (1) difficulty in providing adequate controls, (2) unequal opportunity for students to learn, and, (3) difficulty in obtaining adequate data, especially when the data was dependent upon the student responses. These problems still exist when conducting research in contemporary music classrooms.

Ihrke (1963) examined the pedagogical and psychological implications of automated music training. Major problems of traditional music instruction were addressed: (1) imprecise and delayed feedback, (2) non-individualized pacing, (3) learning by restricted example, and (4) fallacious verbalization. He suggested that all of these difficulties could be eliminated or lessened through programmed instruction. Ihrke also stated that the need for individualized instruction can not be met by traditional methods. The tutoring machine is capable of providing "immediate feedback and can be programmed to provide as precise an analysis of the student's response as may be thought
desirable" (p. 6). He further observed that the writing of programmed materials requires careful thought, and failure must be minimized so that the student can progress at a rate that guarantees success. Ihrke concluded that the biggest task for the programmer is "to attempt to retain some of the warmth of the human teacher in machine training procedures" (p. 17).

LaBach (1965) developed a device to facilitate the learning of basic instrumental music performance skills. A tape recorder, tape loop cartridge, speaker, microphones, and metronome were utilized to supplement instrumental music instruction. The device employed three modes of instruction. In Mode I, the student plays, hears a playback of himself, hears a pre-recorded example of the exercise, and then proceeds. In Mode II, the student hears the pre-recorded example, plays the example, hears a playback of himself, and proceeds. In Mode III (designed for beginners), the student hears a pre-recorded example, plays the example, hears a playback of himself, hears the pre-recorded example again, and then proceeds.

LaBach concluded that "although it is too soon to evaluate the particular device described here, it seems
that various kinds of audio-visual equipment incorporating characteristics of true teaching machines will be developed, and that from this research valuable new instructional materials will emerge" (p. 10).

Jeffries (1967) used programmed learning procedures to test the effectiveness of ordered presentations and random presentations in melodic interval dictation. He suggested that intervals such as the tritone and major seventh should not be treated as more difficult than other intervals. Results showed that students who were presented intervals in a random order of learning sequence achieved better results on tests of interval dictation than students that were presented intervals in steps of "increasing difficulty". This study according to Jeffries may have implications for randomly generated melodies in a tonal memory training program.

In an investigation comparing the effectiveness of programmed instruction with the classroom teaching of sight-singing, Kanable (1969) observed that there was not a significant difference between the two approaches.
The results did suggest a strong relationship between combined tonal memory/error detection (aural/visual) scores and sight-singing scores.

Carlsen (1965) summarized the implications of research problems in programmed instruction. He stated that the technology of programmed instruction deletes the uncontrolled variable of the teacher's personality in experimental research. He further suggested that observing behavior and meeting objective criteria in feasibility studies should be sufficient to support a program's effectiveness. Aural music learning can be facilitated through programmed instruction.

It appears that an effective analysis of the variables of step size, sequence, presentation mode, response mode, practice possibilities, nature of reinforcement, reinforcement schedule and subsequent programs to accommodate them all for each learner would demand a highly complex electronic computer (p.33).

Specific to tonal memory, Carlsen asks, "Is there a transfer of perception from the isolated melodic interval to a contextual situation?" (p. 33). He
concludes that the future of computer-based programs should involve instruction in the aural aspects of music.

Horacek and Lefkoff (1971) also cited problems and solutions of programmed courses in ear training. The problems cited were: (1) difficulty in providing incentive since students are accustomed to working for a teacher, (2) students are unwilling to make decisions regarding organization of their own work, and (3) students get lonesome without teacher-student and student-student interaction. The following were offered as possible solutions: (1) provide advisers to give praise and keep in close contact with the student, (2) provide better programming based on smaller steps, (3) provide more reinforcement for achievement, and (4) require the student to make fewer decisions as to the learning sequence.

Programmed instruction appears to be an effective method for individualizing instruction. Research in the area of programmed instruction has acted as a catalyst to research in computer-assisted music instruction. Sequencing of instruction, reinforcement, and branching have been studied in programmed
instruction research in music. However, in the last decade research utilizing programmed instruction has virtually been replaced by a machine with much greater efficiency, the microcomputer.

**Computer-Assisted Music Instruction**

Kuhn and Allvin (1967) stated that research with computerized systems "would be certain to reveal inadequacies as well as strengths of programmed instruction" (p. 2). Kuhn and Allvin (1967) developed a computer-based approach to sight-singing at Stanford University. Using an IBM 1620 computer and auxiliary hardware, a programmed instruction sequence with immediate and accurate feedback was created. In response to visual stimuli, students sang what they judged to be the appropriate notes. After receiving an evaluation, the students either repeated the task, completed a similar one, or moved ahead in the sequence. The instructional program was equipped with intrinsic (computer controlled) as well as extrinsic (student-controlled) branching. Each student response was evaluated to assure an appropriate learning sequence. The main purpose of Kuhn and Allvin's research was to examine the subjects' reactions to the music program.
presented by the computer. Their findings showed that once comfortable criterion levels were set, the students were much more at ease with the computer. Students were excited when success was achieved. The microcomputer acknowledged this success by stating "Congratulations".

Kuhn and Allvin further observed "some immediate applications might be the development of complete curricula in melodic, rhythmic, and harmonic sight-singing and dictation, including special curricula adapted to elementary and secondary school, as well as to college and university levels" (p.13).

Meanwhile, other researchers have sought to demonstrate the potential application of computers to instrumental teaching areas and composition. From 1967 to 1969, Diehl (1969, 1971) was involved in the development of a CAI laboratory at The Pennsylvania State University in instrumental music to teach articulation, phrasing, and rhythm to wind players. The objectives of this program were focused on ear training and instrumental playing. Although the bulk of the listening program was aural-visual discrimination, the course was sequenced from simple to complex with aural discrimination of phrasing being the first task.
Secondary school clarinet students heard two musical examples played on the clarinet. The students were then asked whether or not the phrasing/articulation was the same or different in the musical examples. The students responded with a light pen or a typewriter keyboard. Students then progressed to visual discriminations, and the actual playing of exercises for further evaluation. This early study in CAI suggests that aural discriminations are basic to other musical skills, and the computer is suitable and capable for this type of instruction.

Diehl and Zeigler (1972, 1973) expanded Diehl's original study (1969, 1971) to include other treble clef woodwind and brass instruments. The results indicated that all but three of the 25 secondary school instrumentalists made significant gains from pretest to posttest (p<.01) in the areas of listening and performance.

Placek (1973) researched the use of the PLATO computer-assisted instruction system at the University of Illinois in the teaching of selected behaviors in rhythm perception. Placek sought to determine the effect of CAI programming on six prospective elementary
school teachers. His findings suggest that the program: (1) responded to individual differences, (2) resulted in the learning of specific behaviors, and (3) elicited a favorable response from the students.

Peters (1974) later expanded the capabilities of the PLATO system to include an audio interface for judging instrumental music performance. Eight university trumpet players participated in a program that provided feedback on pitch and rhythm performance. The results indicated that: (1) it is feasible to evaluate trumpet performance through this program, and (2) the students were motivated to achieve a correct response from the computer. Peters also suggests that the computer should be programmed to provide a high degree of positive reinforcement.

Wittlich (1980) reported on the expansion of the PLATO system to include the Pitch Pattern Perception Program (PPP). PPP is a set of drill exercises for teaching intervals and pitch patterns. In response to patterns that have been played, students may register answers on a touch sensitive screen that allows for different pedagogical approaches by accepting traditional interval names, scale degree steps, MOD 12,
or graphic piano keyboard input formats. Another program, voice leading in triadic tonal music is a succession of exercises comprised of sets of three-to-eight-chord examples in four-voice texture. After a tonic key and mode are established, the program writes a Roman numeral progression beneath the staff and requires the student to notate the example either voice-by-voice or chord-by-chord. The program scores answers by consulting its stored rules for voice leading.

Hofstetter (1979) evaluated a competency-based approach to teaching aural interval identification through the GUIDO program at the University of Delaware. GUIDO is an acronym for Graded Units for Interactive Dictation Operations. The GUIDO system is an outgrowth of the PLATO project. The GUIDO system includes programs that teach the aural identification of intervals, melodies, chord qualities, harmonies and rhythms. Through the use of an instructional table, the instructor has complete control over the lessons and materials which each student will study. This table tells GUIDO what to ask each student, how to ask it, and what action to take in response to the answer. Lesson plans can be tailored for the individual student by
altering/editing the table which controls such factors as type and difficulty of materials, speed or length of dictation, number of re-hearings allowed on each question, response time limits, and percentage of correct responses required before progressing to the next unit.

Hofstetter (1979) evaluated two groups of music majors with regard to the acquisition of aural interval identification. The students were taught ascending intervals using a traditional learning sequence from the Benward ear-training series. One group continued to learn descending, mixed ascending and descending, and harmonic intervals by the same methods in a sequential control group. The other group learned in a competency-based experimental group. The results of this study showed that: (1) there was no significant difference in the amount of learning on the ascending intervals, (2) the competency-based approach led to a much better use of student time, and (3) significantly higher scores were achieved by the competency-based experimental group.

The MElodic DIctation Computerized Instruction (MEDICI) system, used at Florida State University, was
designed to tutor individual students in melodic dictation. Incorporated into the curriculum for freshman music majors, it demonstrates the use of CAI to increase faculty efficiency by recapturing class time previously consumed by drill work. In place of theory drill session, students are required to take 100 minutes per week of melodic dictation on the MEDICI system. In a typical session, the system chooses a melody of an appropriate level, displays a clef, key, and meter signature, plays a tonic chord cadence progression, and then requires the student to notate the melody by touching the appropriate boxes on the screen containing pitches, duration values and other necessary musical symbols. As panels on the screen are selected, the student's answer is written note-by-note on a staff display. Upon completion of the exercise, both the student's answer and the original melody are displayed side-by-side with any difference between the two highlighted. The student may then select to re-hear
the example, jump to drill lessons for interval recognition practice, check personal statistics, or proceed on to another example (Taylor, 1982).

Von Feldt (1971) compared the effectiveness of traditional classroom teaching and computer-assisted instruction in the teaching of visual recognition of music symbols in a public school general music class. The questions Von Feldt asked were: (1) how does computer instruction compare with traditional instruction in terms of achievement gain or loss, (2) how does computer instruction affect students with a high initial achievement score, (3) how does computer instruction affect students with a low achievement score, and (4) is there a comparison between achievement scores and time spent in the two modes of instruction? Von Feldt developed his own program to teach: the staff, grand staff, treble clef, bass clef, letter names of the lines and spaces, ledger lines, notes, rests, note and rest values, accidentals, time
signatures, measure, bar line, double bar line, repeat signs, crescendo, decrescendo, tempo markings, and abbreviations of dynamic markings.

Von Feldt used a control/experimental group design of 37 junior high general music students. Results were based on a pretest/posttest mean, standard deviation, and a t test. The results based on the t test indicated that: (1) CAI is as effective as traditional classroom techniques, (2) CAI does not affect the achievement scores of high initial achievers, (3) CAI is significantly effective in teaching students that possess low initial achievement scores, and (4) CAI teaches as well as traditional classroom teacher instruction, but in 30% less time.

Systems Development Corporation working with the Wichita, Kansas Public Schools and the Wurlitzer Company, conducted a study to determine the feasibility of computer-assisted instruction in bringing keyboard experience programs to large numbers of elementary school children. Three approaches were considered: (1) an instructional management system, (2) an intermediate level of computer-assisted instruction, and (3) an advanced level of computer-assisted instruction.
The researchers concluded that at the time of the study (1970) computer-assisted instruction systems were both technically feasible and had high educational value, but would not be economically feasible for another three to six years.

Humphries (1980) investigated the relationship between the length of time spent on CAI drill and improvement in theory interval identification scores. His target group was a freshman music theory class. The students were divided into four groups: Group 0, the control group, did not receive any CAI time during the study; Group 1 drilled once a week with the computer for 25 minutes; Group 2 had two 25 minute sessions per week on the computer; and Group 3 had three 25 minute sessions per week on the computer. The treatment period lasted for three weeks. Humphries concluded from this study that: (1) three 25 minute sessions per week produced optimal results, and (2) middle achievers learned the most from interaction with the computer-assisted instruction programs.

Deihl and Radocy (1971) reported that computer-assisted instruction "promises a major breakthrough for individualized instruction" (p. 23). They predicted
uses in computer-assisted music instruction in music theory, aural drills, melodic and harmonic dictation, aural-visual discrepancies, and style and performing skills. Deihl and Radocy also assessed the diagnostic potential of the computer to analyze, provide immediate feedback, branch, and coordinate aural/visual stimuli for the individual student.

Swanzy (1971) noted the computer's dual role in music education: (1) data retrieval and (2) computer-assisted instruction. Swanzy observed that CAI implementation is limited by the cost of hardware and the lack of musicians trained in computer technology and programming.

Deihl and Partchey (1974) provide a comprehensive overview of music research in educational technology prior to 1974. Many studies in programmed instruction were annotated. Diehl and Partchey recommend that the computer can be an invaluable tool in drill situations. Lack of computer standardization, however, was recognized as a problem and continues to be a concern today. The authors observed that music instruction requiring repetitive drill can utilize the technology
that computers can offer. This statement has a direct bearing on the implications for the use of the computer in aural discrimination tasks.

Jones (1975) did a survey pertaining to the status of computer-assisted music instruction in colleges and universities. Questionnaires were mailed to 429 universities. Twenty-three responded. Jones recommended that: (1) there is no need for a unique or common program language for music, (2) interface devices capable of music generation should be developed, (3) efforts should be made to facilitate the exchange of CAI efforts, and (4) that drill and practice uses be continued. Jones also noted that few educators are involved in CAI teaching or CAI research. This study suggests a need for further research in computer-assisted music instruction and the development of practical music programs.

Taylor and Parrish (1978) surveyed 1180 public school districts and 233 college music departments to determine their uses of and attitudes toward programmed instruction and computers. Forty-six percent of the schools and colleges contacted responded to the questionnaires. The authors reported that 21% of both
the public schools and the colleges were actively involved in the use of computers. Of the 79% remaining, 9% of the school districts and 19% of the colleges plan to implement computers into their teaching system. Forty-three percent of the colleges and 31% of the school districts believed that the computer will become a necessary tool in public school music education.

Taylor and Parrish (1978) conclude that the next few years of continued research and technical development undoubtedly will contribute to shaping the role of the computer in our educational institutions. Taylor and Parrish further recommend that music educators at all levels should become involved with the uses of computers in the classroom.

Eddins (1978) investigated the use of random access audio in computer-assisted music instruction. He emphasized the importance of having musical sounds readily available. The peripherals described by Eddins are designed for use with the PLATO system. However, these peripherals do have direct implication for use
with the microcomputer, which is also capable of random access audio. Eddins states the following principles of music programming:

1. Concepts should develop from listener interaction with the music. Keep the student involved with the sounds.

2. Keep verbal messages short. The primary information is the music.

3. Give clear, concise verbal prompts on how to respond to the sounds.

4. Always provide a visual context for the sounds. Have something on the screen which relates to the music that is playing (p.28).

Vaughn (1978) investigated the effectiveness of the CAI approach versus the traditional classroom approach in increasing the student’s ability to identify auditory stimuli. Vaughn’s study utilized the 80 students enrolled in a college Basic Musicianship class. He used a control/experimental group design with the data being collected over a period of 20 weeks. Both groups received the same in-class instruction. The experimental group received eight hours of computer-
assisted instruction during the 20 week period. The control group was free to reinforce in-class learning through any manner found satisfactory to each student.

The results of Vaughn's study indicated:
(1) significantly more academic growth in ear-training occurred when students utilized the computer-assisted instruction for this study, (2) it did not make a difference if the type of computer-assisted instruction was melodic, harmonic, or rhythmic - achievement growth occurred in all areas, (3) students using the computer were able to save a considerable amount of time in the development of ear training skills, (4) students showed a willingness to experiment with alternative methods of instruction, and (5) that the concern of music educators toward computer-assisted instruction needs to be addressed before large scale utilization of computers is possible.

Shannon (1982) conducted a study to: (1) implement a CAI drill program of interval recognition for music theory freshman, (2) evaluate the effectiveness of the CAI approach versus a traditional classroom approach, and (3) evaluate the effectiveness of the two approaches under controlled conditions. Shannon's
population consisted of two freshmen music theory classes at two different institutions. The Aliferis Music Achievement Test (1954) was used as the pretest/posttest. The central finding of this study was that the CAI approach was not as effective as the traditional classroom approach. Shannon goes on to state that the aspect of human interaction may be the reason for the more effective role of the traditional approach. He further indicates that student attitude is not more favorable toward ear training when learned via computer than when learned in a classroom setting. Students may feel that isolated drill on skills is irrelevant to their musical interests. Shannon does suggest that: (1) further research should compare the effectiveness of CAI plus group instruction versus group instruction alone, and (2) there is a need for software improvement related to microcomputer-assisted music instruction.

Watanabe (1981) investigated computer-assisted music instruction utilizing compatible audio hardware in computer-assisted aural drill. The content of the CAI was based on instrument identification. The PLATO IV system was used for this study. The results indicated
that: (1) the application of computer programs for aural drill is feasible, and (2) there was not a significant difference between experimental and control group gains in this study.

Hofstetter (1981) describes the advantages of the GUIDO system for CAI instruction. He notes that the use of computer-assisted music instruction results in saving time for both the student and the teacher. By delegating drill and practice to the computer the instructor has more time for advising, individual learning problems, and creative lesson planning. Hofstetter goes on further to state that computer-assisted instruction in music results in student self-motivation rather than peer competition which prevails in the regular classroom.

Shrader (1981) observed that the reluctance of school administrators to implement CAI programs has been due to the high cost of hardware. Now that the microcomputer has become more available, there is a need for good software.

Sherbon (1983) suggested in his study that "the potential applications of microcomputers
in music education are limited only by the knowledge and creativity of the user or programmer" (p. 36).

Canelos, et. al. (1980) suggests that CAI drill can be especially effective when used on learners who have not yet acquired good study habits. By its very nature, CAI guides students towards acquiring new information in a very structured manner and therefore teaches general organizational skills as well as drilling the specific learning task at hand. To investigate this influence of instructional strategies, Canelos compared the learning success of three groups of students studying identical material using self-study with a textbook, programmed instruction, and computer drill. Canelos found that the CAI group produced significantly higher test scores than either of the other two groups. A follow-up test showed that retention of learning by this same CAI group remained significantly higher than that of the other two groups whose test scores declined during the same time period.

Using the MEDICI system described earlier, Taylor (1982) conducted a more extensive study to determine the potential effectiveness of using MEDICI as a substitute
for conventional theory drill classes. Two groups of freshmen theory students received identical classroom lectures for one semester. In addition to the lectures, one group of students received traditional drill classes while the other group used the MEDICI system for drill and practice. No significant differences in test scores were shown, thereby demonstrating that CAI was an effective substitute for traditional drill classes. Further analysis indicated that: (1) the MEDICI group retained the material for a longer period of time, (2) the students seemed to score better when dictation melodies were played by computer generated sound rather than on the piano, and (3) the MEDICI system allowed the students more efficient use of their learning time.

While the majority of research studies have tested the music major, Arenson (1982) tested the non-music major. In a music fundamentals course, Arenson compared the scores of students receiving traditional homework assignments with those assigned PLATO homework instead. Arenson attributed the greater success of the PLATO group to the fact that: (1) the computer drill session was undoubtedly a more structured situation than the individual homework session, (2) PLATO drill provided
students with more immediate feedback than graded homework assignments, and (3) although all students devoted an identical amount of time to assignments, the computer was able to give students amounts of work in those course content areas which were most appropriate to individual need.

A series of four comprehensive studies in the areas of harmonic dictation, interval identification, chord quality recognition, and rhythmic dictation have been conducted by Hofstetter (1978, 1979, 1980, 1981) using the GUIDO system. Above all these studies have demonstrated the immense potential CAI offers as a tool for gaining new insights into the processes students undergo in mastering these skills. Making use of the computer's ability to store student response data, all student responses for each individual exercise may be analyzed. By making it possible to determine exactly where student understanding of any concept fails, it becomes a powerful tool for curriculum revision. Through analysis of response to harmonic dictation exercises, Hofstetter was able to discover definite patterns by which harmonies could be separated into the following pedagogical groups: (1) chords quickly and
easily mastered, (2) chords easily confused with other specific harmonies, (3) chords difficult to master but secure after overcoming this initial learning difficulty, and (4) chords never completely mastered within the limitations of introductory courses. Similarly, analysis categorizing students' incorrect answers provided a very precise understanding of the types of chord confusions which occur during the learning process.

Hofstetter (1980) states that a primary goal of CAI should be the improvement of curriculum sequencing, and he concludes that once sources of confusion can be identified, any curriculum can be greatly improved by simply making appropriate adjustments to the order and frequency by which certain concepts are presented.

Gross and Griffin (1982) investigated the implementation and evaluation of a computer-assisted course in musical aural skills. Their sample consisted of 16 college freshmen. Gross and Griffin designed a five-week course utilizing a pretest/posttest design in which each of the students had two 20 minute sessions of computer-assisted instruction per week. The students could also sign up for additional time if it was
available on the computer. The pace and difficulty level of the microcomputer programs were controlled by the learner. The programs worked on the skill of melodic dictation. The students heard a melody which was generated by the computer. The students then used a keyboard which was interfaced with the computer to input their version of the melody. The computer then displayed both the actual melody played and the one played by the student pointing out any differences between the two melodies. Additional programs asked the student to point out missing notational values or to correct the melody played by the computer.

One problem with this study, which was indicated by the researchers, was that the scores on the pretest were extremely high: 93%. This did not leave much room for improvement during the five week experimental period. The results did indicate: (1) significant differences in performance concerning musical intervals and the recognition of chords as a function of the interaction
with the microcomputer program, and (2) positive attitudes resulted from the interaction with the computer.

Uptis (1982) conducted a study concerning the use of ALF as a tool for teaching music composition. Two subjects aged eight and ten participated in a ten week session with the researcher on an individual basis. The program consisted of compositional activities which also included listening examples. Her results indicated that the ALF program was suitable for adapting to individual learning styles and accommodating individual differences. Uptis concluded that the ALF music system could be potentially useful in initiating an interest in composition on an individual basis. However, the role of the teacher was critical.

Russell (1983) developed a set of microcomputer programs to aid in the analysis of atonal music. Data were not collected. His dissertation consisted only of the development of these programs.

Deal (1983) researched computer-assisted instruction in pitch and rhythm error detection. He compared the CA-PED (Computer-Assisted Program in Error Detection) with the PED (Program in Error Detection).
His purpose was to determine whether or not the CA-PED program was an effective method of developing the skill of pitch and error detection in college music education majors. The CA-PED program, written for the Apple II+, is an interactive programmed-instruction format that utilizes four-voice examples of published band literature. The 65 instrumental music majors were randomly assigned to two groups. The control group was instructed to complete the PED outside of class in no more than six weeks. The experimental group was given the same parameters, however, they were instructed to complete the CA-PED.

The results indicated that: (1) the CA-PED appears to be a successful method of teaching the skill of pitch and error detection to college music education majors, and (2) that CA-PED appears to be no more or less effective than Ramsey's PED.

Lemons (1984) developed microcomputer-assisted materials which could be used to supplement traditional training in music sight-reading. A series of 20 programs were constructed which made use of programmed learning concepts and tachistoscopic training techniques. Each program contained a variety of
activities to: (1) reinforce melodic memory, (2) extend the number of notes perceptible as a visual unit, (3) apply those principles in a rhythmic setting, and (4) to encourage the student to read ahead of the notes actually being played.

A pretest/posttest experimental design was chosen to measure the effectiveness of the supplementary lessons. Nineteen students participated in the experimental group. Treatment consisted of two 20 minute sight-reading lessons per week over a period of ten weeks. Ten subjects were solicited from another university to act as the control group. The control group was asked to practice routinely on sight-reading skills during the treatment period. A sight-reading test, prepared by the researcher, was used to compare the two groups.

The results indicated no significant difference between the experimental and the control groups. However, an analysis of score changes within groups indicated that both groups had improved during the
experimental period. A between group t test using posttest data indicated that the experimental group had scored significantly higher than the control group.

Turk (1984) developed and tested her music listening strategy TEMPO (MLS-TEMPO), an individualized computer-assisted instructional package for the acquisition of tempo discrimination skills, on a select group of junior high school students. Turk used a pretest/instructional phase/posttest design. The instructional phase was divided into two parts: (1) the discrimination of tempo changes, and (2) the identification of accelerando and ritardando in each example. Each part consisted of four sections: (1) monotonic recurring beat patterns, (2) monotonic rhythmic patterns, (3) melodic patterns, and (4) complex musical excerpts. The programs were designed for the Apple II+ microcomputer and interfaced with the alphaSynatauri music system. The MLS-TEMPO was tested on 30 eleven to fourteen year olds. After completing the MLS-TEMPO session, the students completed a
questionnaire designed to gather musical experience information and to assess the subjects' response to the instructional package.

Results showed a significant gain for the eight students who completed the instructional package. Turk notes that all brass and string players met the pretest criterion. The subjects responded positively to the instructional package. These findings indicate that the MLS-TEMPO may be an effective instructional tool with junior high instrumental students.

Robinson (1984) investigated the development and evaluation of his own microcomputer-assisted music instruction program for the improvement of tonal memory. The effectiveness of his instructional program was measured by the appropriate subsections of the Seashore Measures of Musical Talents, Drake Musical Aptitude Tests, (Wing) Standardized Tests of Musical Intelligence and the (Gaston) Test of Musicality.

Robinson selected 20 students in each of the following grades: fourth, sixth, eighth, and tenth. He divided them into two groups: control and experimental. The control group received only their regular classroom music instruction over the eight-week period. The
experimental group received an additional hour per week of computer-assisted instruction. The results indicated: (1) there was no significant difference in the tonal memory gain scores of students who receive training with the microcomputer-assisted music instruction and students who participated in only regular classroom music instruction, and (2) there were no statistically significant differences in the gain scores of the four different grade levels of students who received the training program.

Kolb (1984) developed a real-time microcomputer-assisted system for translating aural, monophonic tones into music notation as an aid to sight-singing students. Specialized hardware and software were developed for the tasks of solving the following problems in real-time: (1) the extraction of the fundamental frequency of vocal tones, (2) the detection of the pitch of those tones and, (3) the display of those pitches in standard music notation for visual feedback to the student.

The system which Kolb developed has the following capabilities: (1) displaying standard music symbols in high resolution graphic images, (2) accessing a library of melodies to be used in student testing,
(3) generating sound for the purposes of aurally establishing the key of melodies and playing those melodies, (4) displaying in real-time the pitches the student is singing, (5) evaluating the students' performance of a melody, (6) transposing the key of melodies to a key that allows the melody to lie in a comfortable range for the student, (7) tailoring the sequence of melody selection to the abilities of the student, (8) creating and maintaining a file of session statistics for each user during each practice session without any human intervention, and (9) operating in a free mode in which the student may sing any series of pitches he desires. Kolb tested his system for one semester on a freshmen class of music majors. The results of this study were not significant. The informal results, however, suggested that this system may hold a useful position in the development of sight-singing skills.

Vaughan (1984) investigated the use of computer-assisted music instruction in the general music classroom and its effect on student achievement. This study was aimed at the staff development of a group of teachers who would establish a network of people using
computers and then determine whether music instruction using select software and hardware from the Minnesota Educational Computer Corporation (MECC) was effective in the music classroom.

The experimental group consisted of students who were instructed by teachers who attended the inservice training session. The control group was instructed by teachers who had applied for the inservice, but had not been selected for its first phase. Students in the experimental group received one-half hour per week of instructional time in computer-assisted instruction. Both the control group and the experimental group received the same amount of time each week in music-related activities.

The results indicated that: the experimental group performed significantly better than the control group. The results suggest that students benefit from computer-assisted instruction in classroom music when music theory is taught, and that emphasis should be placed on instruction using the computer whenever it is appropriate to curriculum objectives.

Meckley (1985) developed a highly individualized computer-based music learning sequence for learners
using the LOGO music version language. Ten volunteer subjects aged nine to eighteen participated in a series of private music lessons taught by the researcher. Detailed subject profiles and records were kept. Subjects learned basic entry and editing techniques of the LOGO language. After the preliminary programming, the students worked on composition, advanced programming techniques, and individual projects. Instruction programmed examples by the researcher assisted in initial tonal and rhythmic organizations.

Meckley concludes that the LOGO music version is a potentially powerful means for the development of individualized music instruction, but that it is vital to balance the three-way interaction among student, computer, and instructor according to individual needs. The LOGO language was especially effective in meeting the individual needs of the gifted and physically handicapped students in this study.

Dangelo (1985) investigated whether or not intermediate elementary school students receiving short-term computer based instruction in music fundamentals would exhibit and retain a level of competency in music fundamentals significantly higher than students
receiving only traditional music classroom instruction. Dangelo tested 18 students aged eight to ten who had not been involved in previous private music lesson instruction. His results indicated that neither group significantly exceeded the other in the competency skills of music fundamentals. A retention test given 112 days after the posttest indicated the same results: no significant difference between the two groups.

Eisele (1985) developed a computer-assisted instruction program to improve the pitch discrimination skills of sixth, seventh, and eighth grade violin and viola students. The Intonation Skill Development Program (ISDP) was written as a violin/viola fingering and pitch matching tutorial/drill and practice program to assist both the teacher and the student. The subject group was comprised of 50 second to fourth year violin and viola students. Students who progressed through the ISDP worked independently on their assigned Apple II+ microcomputer. Each student progressed through the program a total of three times during the three week long study.

Test measures consisted of the Music Achievement Test (Colwell, 1968) and the researcher designed
Instrumental Performance Test (IPT). Significantly higher \( (p<.05) \) scores were achieved on the MAT by the students who used the computer-assisted instruction program. The results indicated that if a computer-assisted instruction program such as the ISDP were to be incorporated into a traditional program, pitch perception could be improved. Eisele goes on to conclude that perhaps with a more extended treatment period, the pitch improvement might affect performance skills in a measurable way.

Pembrook (1986) conducted a survey of 75 sophomore music theory students and their attitudes towards a computer-based melodic dictation program (MEDICI). The students filled out a 34 item questionnaire which evaluated their opinions pertaining to the selection of hardware, software and departmental requirements regarding the computer-based instruction.

Pembrook found that: (1) the hardware and software were generally found to be useable by the students, (2) the students felt that the MEDICI program required too much time outside of class, (3) too much progress
was expected in too little time, and (4) the increase in difficulty levels was not consistent throughout the program.

Based upon this survey, Pembrook suggests the following implications: (1) programmers should use larger areas on the touch sensitive screen to eliminate touch errors, (2) more positive feedback should be incorporated into the programming, (3) teachers should be sensitive to the amount of time scheduled to complete the computer task and its relationship to credit hours required, and (4) the need to minimize cheating by students using the computer-based instruction.

Computer-assisted instruction was never intended to replace teachers. However, it can be justified on the basis of its potential for reallocating teaching time away from routine tasks toward the more creative uses of instructional time (Hofstetter, 1980). CAI research has shown that it can be used as a substitute for certain types of classroom activities, freeing the teacher to devote more time to lecture preparation and individual interaction with students (Arenson, 1982; Hofstetter, 1981; Taylor, 1982; Vaughan, 1984). While class time may be too limited to cover all topic areas
of a course in depth, students with special interests can be provided with enrichment activities according to personal abilities. Remedial tutoring can also be provided for the smaller portion of the class who lacks the necessary background in a particular area. Finally, the ability of CAI systems to monitor student progress provides the discipline of music education with a powerful evaluation tool for effective curriculum revision. It is also an invaluable source of research data for a better understanding of how students learn.
Chapter III

PROCEDURES

Musical learning depends upon our perceptions of the sounds which we hear. Music is an aural art form. According to Zimmerman (1971), there is a developmental sequence as to the acquisition of aural abilities involved in musical discrimination tasks. The first discrimination to develop is the perception of loud and soft, next comes pitch and rhythm concurrently, with harmony or simultaneous sounds developing last.

Based upon the findings of Zimmerman (1971) and Petzold (1966), this researcher began to look for computer-assisted music instruction programs which would be appropriate for use with first-grade children both in the material presented and in the tonal memory/aural perceptions tasks required of the child. Instructional programs were chosen that were compatible with the
learning process of the child and which focused upon the music itself and not merely the symbols which represent the music.

**Review of Selected Software**

In the initial stages of this study, catalogs, general information, and software were requested from the major software companies who advertised in either educational journals or computer magazines. (Appendix A).

During this review process, it was determined that almost all of the software currently available was geared toward the drill and practice/game concept. Many of these programs required some knowledge of musical terms prior to being useable in the classroom situation. Most of the software has been developed for children with a third/fourth grade and above reading level ability.

The researcher chose two programs from the Micro Music Software Library, a division of **Temporal Acuity**
Products, for use in this research study: The Magic Musical Balloon Game and Toney Listens to Music.

The Magic Musical Balloon Game was designed by Sally Monsour and Charles Knox. Initially the student hears a segment of melody which is generated by the microcomputer. The student is then asked to press either U (Up), D (Down), or S (Same) in order to indicate the direction in which the melody moved. If the student is correct with his first response, then the graphics of the moving balloon reinforce the answer given by the child. The computer replays the melodic fragment, while the balloon is moving, thereby reinforcing visually and aurally the direction of the melodic segment. The child then proceeds on to the second segment of the melody. Each melody is made up of four short segments.

If the child does not give the correct response on his first try, then the computer replays the melodic segment and asks the student to "Try again". The student is given two trials before the computer states the correct answer, replays the melodic fragment, and
visually moves the balloon. The child then proceeds on to the next segment of the melody. The child must respond to each directional fragment.

After the child has heard, responded, and seen each of the four melodic segments individually, the computer then replays the entire melody and moves the balloon according to the melodic direction of each segment. The computer does keep score while the child is playing the game. Each time he makes a correct response a treble clef appears in the upper right hand portion of the computer screen. At the end of the game the total number of correct responses are added together and the child is given his score along with a motivational term: "World Traveler," "Commuter," or "Stay at Home".

In preparation for reading music notation on a staff, the following screen is scrolled for the student to read:

WRITTEN MUSIC HAS NOTES ON LINES OR BETWEEN LINES. LIKE THE BALLOON THE NOTES GO UPWARD WHEN THE MUSIC GOES UPWARD AND DOWNWARD WHEN THE MUSIC GOES DOWNWARD. THE MUSIC FOLLOWS THE NOTES.
A melody is then played while the balloon moves up and down over a five line staff to show the direction in which the melody is moving. The balloon is used to represent the actual pitches which the student hears.

The next screen which the student sees is:

DO YOU WANT TO PLAY THIS GAME AGAIN?
PRESS Y (YES) OR N (NO).

If the child responds with Y, the exact same game is repeated. If the child responds with N, the following question appears:

DO YOU WANT TO PLAY A NEW GAME?
PRESS Y (YES) OR N (NO).

If the child responds with Y then the computer goes on to do the second or third game in the sequence. If the child responds with N, then the computer exits with:

I ENJOYED PLAYING WITH YOU. BYE.

There is a reminder then to the child to turn off the computer and remove the disk.

This program contains three different games. Each game consists of four melodies broken into four melodic
segments. The first two games use the balloon as the visual aid, while the third game uses actual notes on the staff. The scrolled screen is seen only after the first two games.

In order to use this program, the student must be acquainted with the idea that melodies can move up, down, or stay the same. He must also be able to locate the keys U, D, S and "caps lock" on the computer keyboard. All of the Micromusic Software programs require that the "caps lock" key be depressed or the programs will not run. The child should also be able to recognize visually the words "balloon," "follow," "look," "listen," "practice," "music," and "again".

When the program is initially loaded into the computer, the following questions are asked:

DOES YOUR COMPUTER HAVE A DAC BOARD?
Y(ES) OR N(O)?

WHAT SLOT IS THE MUSIC BOARD IN 2 OR 4?

DID YOU HEAR A TUNE (Y OR N)?

HAVE YOU PLAYED THESE GAMES BEFORE?
Y(ES) OR N(O)?
These questions can either be answered by the child or the teacher. If the child has not played or experienced the games before, the computer runs the child through a practice example. The following sequence is used:

**THE MAGIC MUSICAL BALLOON GAME**

THE BALLOON FOLLOWS THE MUSIC. (new screen)

LISTEN TO THE MUSIC

LOOK AT THE BALLOON! (Example is played)

LISTEN TO MORE MUSIC.

BE READY TO ANSWER

IF THE MUSIC GOES

UPWARD PRESS U
STRAIGHT AHEAD PRESS S
DOWNWARD PRESS D

(Example is played)

During the practice examples the student keeps pressing the keys until he finds the correct answer. The term "Try again" is not seen during these practice exercises, but it is used during the actual program.

The researcher’s reasons for choosing this particular program pertain to: (1) the limited number of keys which the student must be able to locate on the computer keyboard, (2) the degree of clarity in which
the program utilizes the concept of melodic movement, (3) the repetition and use of two modes of reinforcement (visual and aural), (4) the length of the melodic segments, (5) the clarity of the examples, and (6) the ability of the program to move the child from graphic representations into beginning note reading on the staff.

Toney Listens to Music was designed by David B. Williams and Donna Brink Fox. Toney provides non-verbal instructional materials based upon the concept of same/different auditory discriminations using musical examples. The discrimination tasks range from simple to complex and include the areas of melodic motion, interval size, tempo, timbre, and rhythmic patterns. Toney contains ten different levels of 25 items each.

Because this program functions independently of a teacher, it is possible to collect data without interference or distraction to the student. The record-keeping options provide a detailed analysis of the child’s progress by music trial and level as well as by performance criterion level. In order to use this record-keeping option, however, the program must be loaded into the computer and the teacher must input the
child's name and the appropriate level for the child to begin working with Toney prior to the child's interaction with the program.

The authors of this program have targeted its use for children from ages three to eight. Because of this targeted age level, the programmer has preset the position of the DAC board in the computer program. This means that if the teacher has already loaded the program and entered the child's name, then the child is ready to begin working with the program immediately rather than having to answer some initial questions.

This program requires the child to be able to locate and press the keys (T) for Toney, (R) for rest, 1, 2, space bar, and the --> (arrow key). This program also requires that the child have an understanding of the concept same/different prior to using the program.

David B. Williams has designed a fictional character to represent Toney. Initially Toney appears on the screen toward the top of the monitor. In order for the child to hear the melody or rhythm which Toney is hiding, he must press the letter "T". After the child has heard Toney's melody, then two boxes appears on the lower portion of the screen. Inside the box on the left
hand side of the screen is the numeral 1. Inside the box on the right hand side of the screen is the numeral 2. In order to hear what is inside the box on the left hand side of the screen, the child must press the numeral 1. In order to hear what is inside the box on the right hand side of the screen, the child must press the numeral 2. The child may press the letter T to rehear Toney's melody as well as the numerals 1 and 2 prior to making a decision. His task is to find the box which matches Toney's melody.

Once the child has made a decision, he presses the space bar. This raises a graphic picture of a hand on the screen. The child must "raise his hand" by pressing the space bar before he can give his answer. Once the hand is on the screen, the child presses either the numeral 1 or 2 to tell the computer which melody matches the one hidden by Toney.

If the child is correct then Toney smiles and he appears in both boxes (the original box and the numbered one which the child chose). Both melodies are played providing visual as well as aural reinforcement of the correct choice by the child. Just prior to playing the
melody at this point, an animated portion of Toney (eyes, nose, mouth, headphones, or a quick two-step) moves to indicate his pleasure at the correct choice.

If the child chooses an incorrect response, then the Toney figure changes to one with a sad face, and the box with the incorrect choice displays a large X. Toney again provides immediate feedback by replaying both of the examples so that the child can listen and compare again, knowing that the examples are not the same.

At this point in the program the --> (arrow key) appears in the upper right hand portion of the screen. The child must tell the computer that he is ready to continue with the next example by pressing the matching arrow key.

Two other symbols are used in this program. At any time during the program the child can press the letter "R". This indicates to the computer that the child would like to rest for a moment prior to moving on to the next example. The figure of Toney resting will also appear on the screen when the child has completed a level (25 items) or reached the criterion level preset by the teacher. When the child has reached the end of a particular level, an arrow key pointing up or
down may be seen. If the arrow key is pointing up, then the child is moving up one level in the program. If the arrow key is pointing down, then the child is moving down a level for review purposes. If Toney appears holding a stop sign it is an indication for the child to call the teacher. The stop sign figure indicates that the child has used too much time within a trial and the teacher does need to intervene and reset the control options.

The control options which can be used in this program permit the teacher to: (1) maintain a record of student performance on the Toney disk (up to 30 student records can be kept on the Toney disk), (2) change the tempo of the music items to be presented, (3) change the order of presentation from sequential to random, (4) change the slot for the DAC Board, (5) alter the range of levels and number of items per level which are accessible during a Toney lesson, (6) establish performance criteria, and (7) turn off the automatic level advance so the teacher can control student progress.

Toney Listens to Music includes ten levels with 25 music patterns at each level. Each level emphasizes
one music concept, except for level seven which includes 13 tempo examples and 12 timbre discriminations.

**Level 1**

**Easy familiar**

Toney: first phrase of a familiar children's song

Contrast: first phrase of a different children's song.

The examples for this level include many songs found in currently published music textbook series for kindergarten, first and second grades.

**Level 2**

**Pitch motion**

Toney: an interval which moves up, down or stays the same.

Contrast: An interval which begins on the same pitch but moves in a different direction.

**Level 3**

**Large interval Size**

Toney: an interval which moves up, down, or stays the same.

Contrast: an interval which moves in the same direction but with a difference in interval size of a major third or greater.

**Level 4**

**Easy Rhythm**

Toney: Four beat rhythm patterns using half, quarter, dotted quarter and eighth notes. No rests.

Contrast: Obviously different patterns using the same rhythmic values. No rests.
<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 5</strong></td>
<td><strong>Easy Melody</strong></td>
</tr>
<tr>
<td></td>
<td>Toney: 4, 6 and 8 beat melodic patterns using stepwise and triadic motion.</td>
</tr>
<tr>
<td></td>
<td>Contrast: 4, 6 and 8 beat melodic patterns with a substantial change in direction or interval size.</td>
</tr>
<tr>
<td><strong>Level 6</strong></td>
<td><strong>Small interval Size</strong></td>
</tr>
<tr>
<td></td>
<td>Toney: an interval which moves up, down, or stays the same.</td>
</tr>
<tr>
<td></td>
<td>Contrast: an interval which moves in the same direction but with a different interval size of a minor third or less.</td>
</tr>
<tr>
<td><strong>Level 7</strong></td>
<td><strong>Tempo and Timbre</strong></td>
</tr>
<tr>
<td></td>
<td>Toney: a phrase of a familiar children's song.</td>
</tr>
<tr>
<td></td>
<td>Contrast: first 13 items are either faster or slower in tempo; last 12 items are different in timbre.</td>
</tr>
<tr>
<td><strong>Level 8</strong></td>
<td><strong>Difficult-Familiar</strong></td>
</tr>
<tr>
<td></td>
<td>Toney: first phrase of a familiar children's song.</td>
</tr>
<tr>
<td></td>
<td>Contrast: same phrase but with or two notes changed in pitch.</td>
</tr>
<tr>
<td><strong>Level 9</strong></td>
<td><strong>Difficult melody</strong></td>
</tr>
<tr>
<td></td>
<td>Toney: 4, 6, and 8 beat melodic patterns using a stepwise and triadic motion.</td>
</tr>
<tr>
<td></td>
<td>Contrast: Same 4, 6, and 8 beat pattern with only a slight change in 1 or 2 pitches.</td>
</tr>
</tbody>
</table>
Level 10
Difficult rhythm
Toney: four-beat patterns using half, quarter, dotted quarter, and eighth notes. No rests.
Contrast: Same four-beat rhythm pattern with slight changes; includes rests, dotted eighths, and sixteenth notes.

The researcher's reasons for choosing this particular program pertain to: (1) the limited number of keys which the student must be able to locate on the computer keyboard, (2) the degree of clarity in which the program presents the concept of same/different, moving the child from simple to complex tasks, (3) the repetition and use of two modes of reinforcement (visual and aural), (4) the repetition and self checking when there is a wrong answer entered by the child, (5) the length of the segments, (6) the clarity of the examples, (7) the control options which the teacher can control, and (8) the recordkeeping possibilities for data research.

Validation Procedures of Selected Software
The selected software was then validated by four persons whose expertise included music as well as knowledge of elementary school children. One was a
public school music specialist, and three were experienced professors of music education at The Ohio State University. These individuals were asked to work through each of the selected computer-assisted music instruction programs and rate it according to the following:

1. child would relate-react-respond to this program
2. questionable if child could respond to this program
3. child unlikely to respond to this program - confusing.

The committee agreed that first grade students would be able to relate-react-respond to both of the computer-assisted instruction programs selected for use in this study.

After this portion of the validation process was completed, the computer-assisted instruction programs were field tested on a group of 25 first grade students currently enrolled in the Bexley, Ohio school system. The programs were field-tested in order to determine whether or not first grade students could understand and follow the directions printed in the computer-assisted instruction programs. The results from this field test indicated that the first-grade students
could easily load and run *The Magic Musical Balloon* program. However, some teacher intervention was needed to begin the *Toney Listens to Music* program. This intervention by the teacher was necessary to turn on the record-keeping portion of the program and to start the student at the appropriate level of instruction. If the teacher did not change the level of instruction, then the student would always begin with level one, item number one.

The results also indicated that the first-grade students could easily respond/relate to both of the computer-assisted instruction programs. The only difficulty which was encountered pertained to the quick scrolling of the printed message at the end of games one and two in *The Magic Musical Balloon Game*. The message went by so quickly that most of the students had trouble reading the words.

**Validation Procedures Pretest/Posttest**

The next procedure was to generate listening examples which would test the concept of melodic direction as well as tonal memory skills. The listening items were developed and revised over the course of two pilot studies. The listening activities were validated
by four musicians: three who were professors of music education at The Ohio State University and one who was a Ph.D. candidate in music education at The Ohio State University.

A tape of listening examples was constructed by the researcher. The musical examples were written by the researcher. The musical examples in Part A were played by a trumpet major at The Ohio State University. The examples in Part B were played by a doctoral candidate in music education whose primary instrument was the violin at The Ohio State University. The tape was organized into two parts. The musical examples in the first section pertained to melodic direction and were played on a trumpet. Upon listening to each example, the validators were asked to determine whether the musical examples moved up, down or stayed the same. The examples in the second section pertained to tonal memory and were played on a violin. The validators heard two melodic segments and were asked to respond if they were the same or different. This portion of the validation process was done individually. The committee determined that the musical examples were in fact valid.
The musical examples in Part A were clear indicators of up, down or same, while the musical examples in Part B were clear as to their connotation of same or different.

The response items and selection of listening examples went through two revisions in conjunction with two pilot studies before beginning the main study.

Answer sheets (Appendix B) were designed to accompany this particular test and directions (Appendix C) for the pre-recorded tape were written. Upon consultation with teachers and administrators in the elementary public schools and professors of elementary and exceptional education, the answer sheets were designed with both pictures and words to represent the concepts. This decision was based upon the language development level of the first-grade students. By including both the picture and the word, the child could easily indicate what he heard in the listening example rather than struggling with the necessary language skills.

**Pilot Study I**

The initial pilot study was conducted with 40 first-grade students enrolled in the Worthington
elementary school district in Columbus, Ohio on January 27th and 28th, 1986. The music specialist at this school is also a Ph.D. candidate in music education.

The students were instructed that they were taking part in an experiment to design and then test a test. The students were each given an answer sheet and a crayon with which to circle their answer. The students were randomly scattered throughout the music room and were instructed to look only at their own paper.

The students were then instructed to listen to the directions on the pre-recorded tape and to do the practice exercises for Part A. The researcher then stopped the tape and asked if the students had any questions. The students did not have any questions at this point. The students were then instructed to turn the page, listen to the musical example, and circle the best answer (up, down or same). The students were asked to respond to 15 different musical examples. (Appendix C). Only part A (melodic direction) was given on January 27th, 1986.

On January 28th, part B (tonal memory) was administered to the same first-grade students. The students were each given an answer sheet and a crayon
with which to circle their answer. The students were seated at their desks in their own classroom for this portion of the exam. The reason for this change was to make it easier for the students to keep their eyes on their own papers as well as to keep them from moving around on the floor and making soft rustling noises which became distracting when listening to the musical examples.

The students were then instructed to listen to the directions on the pre-recorded tape and to do the practice exercises for Part B. The researcher then stopped the tape and asked if the students had any questions. The students did find the pictures somewhat confusing for this portion of the test. The researcher then reviewed the concept of same and different with the children pointing to the pictures on the test and singing an example of each.

The students were then instructed to turn the page, listen to the musical example, and circle the best answer (same, different). The students were asked to respond to ten different musical examples. (Appendix C). No further assistance, except at the very beginning to clarify what the pictures meant, was given
to the students. Their interaction with the test came only from the pre-recorded directions and musical examples. Each part of the test required approximately ten minutes to administer.

The two sections of the test were given on different days based upon the average attention span of children in the pre-operational stage of development.

Results and Discussion of Pilot Study I

The first-grade students were very cooperative with regard to the taking of the pilot test. Many of the students commented favorably on the playing of the trumpet and the violin. General observations while the students were taking the test included:

1. The students had no trouble following the directions in part A.

2. The time between the examples needs to be lengthened slightly in order to give the students ample time to circle their answer.

3. There was some confusion on the part of the students with the use of the pictures in Part B of the pilot test. This was due to the fact that the pictures did not mean the same thing as they did on part A. A rearrangement of the pictures to clarify this concept was necessary.
4. The students had a tendency to circle their answer on part B before they had listened to both examples. The words "circle your answer" needed to be included in the pre-recorded tape to eliminate confusion.

The results of the test indicated that the pilot study test examples were, on the whole, too easy. Over one-third of the students received perfect scores. Statistical procedures of item difficulty and item discrimination were completed after the tests were scored and are shown in Table 1.
### Table 1. Results of Pilot Study I

<table>
<thead>
<tr>
<th>Example</th>
<th>Item Difficulty</th>
<th>Item Discrimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1. A</td>
<td>1.</td>
<td>.900</td>
</tr>
<tr>
<td>2.</td>
<td>.725</td>
<td>.33</td>
</tr>
<tr>
<td>3.</td>
<td>.225</td>
<td>-.06</td>
</tr>
<tr>
<td>4.</td>
<td>.625</td>
<td>.47</td>
</tr>
<tr>
<td>5.</td>
<td>.575</td>
<td>.26</td>
</tr>
<tr>
<td>6.</td>
<td>.775</td>
<td>.33</td>
</tr>
<tr>
<td>7.</td>
<td>.725</td>
<td>.13</td>
</tr>
<tr>
<td>8.</td>
<td>.500</td>
<td>.27</td>
</tr>
<tr>
<td>9.</td>
<td>.475</td>
<td>.40</td>
</tr>
<tr>
<td>10.</td>
<td>.650</td>
<td>.27</td>
</tr>
<tr>
<td>11.</td>
<td>.750</td>
<td>.27</td>
</tr>
<tr>
<td>12.</td>
<td>.575</td>
<td>.19</td>
</tr>
<tr>
<td>13.</td>
<td>.575</td>
<td>.46</td>
</tr>
<tr>
<td>14.</td>
<td>.625</td>
<td>.53</td>
</tr>
<tr>
<td>15.</td>
<td>.600</td>
<td>.13</td>
</tr>
<tr>
<td>Part 1. B</td>
<td>1.</td>
<td>.789</td>
</tr>
<tr>
<td>2.</td>
<td>.473</td>
<td>.80</td>
</tr>
<tr>
<td>3.</td>
<td>.815</td>
<td>.80</td>
</tr>
<tr>
<td>4.</td>
<td>.815</td>
<td>.80</td>
</tr>
<tr>
<td>5.</td>
<td>.815</td>
<td>.80</td>
</tr>
<tr>
<td>6.</td>
<td>.578</td>
<td>.70</td>
</tr>
<tr>
<td>7.</td>
<td>.763</td>
<td>.70</td>
</tr>
<tr>
<td>8.</td>
<td>.842</td>
<td>.90</td>
</tr>
<tr>
<td>9.</td>
<td>.789</td>
<td>.50</td>
</tr>
<tr>
<td>10.</td>
<td>.842</td>
<td>.40</td>
</tr>
</tbody>
</table>

Coefficient alpha = .7039

Item difficulty represents the percentage of the group who chose the correct response. From Table 1 it
is clear that the items, on the whole, were much too easy. The percentages indicate that over 50% of the class was answering each item correctly.

Item discrimination represents whether or not each item is a good indicator of how the students will score from the high and low groups. The test should contain some items which are highly discriminating items (.7 - .9) and some items which are not discriminating (.0 - .2). From Table 1 it is clear that most of the items on this particular test were not discriminating.

Coefficient alpha is the basic formula for determining reliability based on internal consistency. It is the relationship among the test items and among each item of the test and the test as a whole. In other words, it is the average of all possible split halves that could be calculated. The coefficient alpha for this test (.7039) showed that it was a reliable test. However, since the top twenty-seven and one-half percent achieved perfect scores, the test was essentially too easy for a treatment period and then a posttest.

Based upon these results, the test needed to be made longer and the examples needed to be lengthened as well as made more difficult. Specifically, the size of
the intervals used in the musical examples needed to be made smaller. The examples needed to include more descending melodic lines, minor intervals, and half steps to make the musical examples more difficult in order for the test to be an appropriate measurement tool for this study.

Other factors affecting the first pilot test included:

1. The difficulty of working within the complicated activity schedules of several classrooms.

2. The physical characteristics of the room used for the testing. This particular room was carpeted and did not contain any desks or chairs for the students to use while taking the test.

Pilot Study II

The second pilot test was conducted with 48 first grade students enrolled in Beacon elementary school, a part of the Hilliard City School District, which is a suburb of Columbus, Ohio, on February 24th and 26th, 1986. The appropriate changes had been made concerning the pilot test. The picture of the rocket on part B of the answer sheet was changed to a picture of a fence so that the meaning of same and different became clearer
(Appendix D). Two seconds of time was added between each of the musical examples in order to insure ample time for answering each of the questions. The musical examples were lengthened and restructured. The researcher also included more examples in minor keys with much narrower ranges and varied the meter signatures more frequently. Each portion of the pilot test was now comprised of 25 musical examples (Appendix E).

The pilot test was again administered over a two day period with the students. The actual length of each portion of the test was approximately 15 minutes. The students were seated at desks and instructed to follow the directions on the pre-recorded tape. If the students had a question, they were instructed to raise their hand. No outside help was given to the students. Their interaction with the test came only from the pre-recorded directions and musical examples.

Results and Discussion of Pilot Study II

These first-grade students were very cooperative with regard to the taking of the pilot test. The
students again commented favorably on the playing of the violin and the trumpet. General observations while the students were taking the test included:

1. the students did not have any trouble following the directions on either section of the test

2. there was ample time for the students to answer each question

3. the inclusion of the words "Circle your answer" in part B helped the students to listen to both examples prior to circling their answer

Statistical procedures of item discrimination and item difficulty were completed after the scoring of the tests and are shown in Table 2.
Table 2. Results of Pilot Study II

<table>
<thead>
<tr>
<th>Example</th>
<th>Item Difficulty</th>
<th>Item Discrimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>.88</td>
<td>.20</td>
</tr>
<tr>
<td>2.</td>
<td>.83</td>
<td>.20</td>
</tr>
<tr>
<td>3.</td>
<td>.81</td>
<td>.50</td>
</tr>
<tr>
<td>4.</td>
<td>.55</td>
<td>.30</td>
</tr>
<tr>
<td>5.</td>
<td>.71</td>
<td>.40</td>
</tr>
<tr>
<td>6.</td>
<td>.50</td>
<td>.80</td>
</tr>
<tr>
<td>7.</td>
<td>.75</td>
<td>.50</td>
</tr>
<tr>
<td>8.</td>
<td>.31</td>
<td>.50</td>
</tr>
<tr>
<td>9.</td>
<td>.60</td>
<td>.60</td>
</tr>
<tr>
<td>10.</td>
<td>.76</td>
<td>.60</td>
</tr>
<tr>
<td>11.</td>
<td>.64</td>
<td>.50</td>
</tr>
<tr>
<td>12.</td>
<td>.81</td>
<td>.50</td>
</tr>
<tr>
<td>13.</td>
<td>.40</td>
<td>.30</td>
</tr>
<tr>
<td>14.</td>
<td>.57</td>
<td>.10</td>
</tr>
<tr>
<td>15.</td>
<td>.63</td>
<td>.60</td>
</tr>
<tr>
<td>16.</td>
<td>.31</td>
<td>.50</td>
</tr>
<tr>
<td>17.</td>
<td>.62</td>
<td>.90</td>
</tr>
<tr>
<td>18.</td>
<td>.74</td>
<td>.40</td>
</tr>
<tr>
<td>19.</td>
<td>.55</td>
<td>.40</td>
</tr>
<tr>
<td>20.</td>
<td>.60</td>
<td>.30</td>
</tr>
<tr>
<td>21.</td>
<td>.48</td>
<td>.70</td>
</tr>
<tr>
<td>22.</td>
<td>.60</td>
<td>.90</td>
</tr>
<tr>
<td>23.</td>
<td>.62</td>
<td>.30</td>
</tr>
<tr>
<td>24.</td>
<td>.75</td>
<td>.70</td>
</tr>
<tr>
<td>25.</td>
<td>.38</td>
<td>.40</td>
</tr>
</tbody>
</table>
Table 2 (continued)

<table>
<thead>
<tr>
<th>Example</th>
<th>Item Difficulty</th>
<th>Item Discrimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.60</td>
<td>.23</td>
</tr>
<tr>
<td>2</td>
<td>.73</td>
<td>.62</td>
</tr>
<tr>
<td>3</td>
<td>.75</td>
<td>.46</td>
</tr>
<tr>
<td>4</td>
<td>.65</td>
<td>.54</td>
</tr>
<tr>
<td>5</td>
<td>.56</td>
<td>.39</td>
</tr>
<tr>
<td>6</td>
<td>.60</td>
<td>.69</td>
</tr>
<tr>
<td>7</td>
<td>.65</td>
<td>.69</td>
</tr>
<tr>
<td>8</td>
<td>.63</td>
<td>.54</td>
</tr>
<tr>
<td>9</td>
<td>.69</td>
<td>.47</td>
</tr>
<tr>
<td>10</td>
<td>.54</td>
<td>.24</td>
</tr>
<tr>
<td>11</td>
<td>.48</td>
<td>.31</td>
</tr>
<tr>
<td>12</td>
<td>.69</td>
<td>.46</td>
</tr>
<tr>
<td>13</td>
<td>.75</td>
<td>.54</td>
</tr>
<tr>
<td>14</td>
<td>.46</td>
<td>-.07</td>
</tr>
<tr>
<td>15</td>
<td>.65</td>
<td>.54</td>
</tr>
<tr>
<td>16</td>
<td>.77</td>
<td>.46</td>
</tr>
<tr>
<td>17</td>
<td>.81</td>
<td>.46</td>
</tr>
<tr>
<td>18</td>
<td>.46</td>
<td>.38</td>
</tr>
<tr>
<td>19</td>
<td>.63</td>
<td>.15</td>
</tr>
<tr>
<td>20</td>
<td>.63</td>
<td>.39</td>
</tr>
<tr>
<td>21</td>
<td>.27</td>
<td>-.15</td>
</tr>
<tr>
<td>22</td>
<td>.75</td>
<td>.46</td>
</tr>
<tr>
<td>23</td>
<td>.67</td>
<td>.0</td>
</tr>
<tr>
<td>24</td>
<td>.56</td>
<td>.31</td>
</tr>
<tr>
<td>25</td>
<td>.81</td>
<td>.38</td>
</tr>
</tbody>
</table>

Coefficient alpha = .8019

The results of the test indicated that this version of the pilot study was a reliable measure of melodic direction and tonal memory. Three of the examples on part B did have a negative or zero discrimination index. These three examples were exchanged for three examples from part B of the first pilot study test with high
discrimination indexes. Example number three (I) became number fourteen (II), example number five (I) became number twenty-one (II), and example number eight (I) became number twenty-three (II) (Appendix F).

The scores for the test covered a broad range. No one, however, received a perfect score. Most of the scores fell in the median range, thereby allowing for growth by the students during the treatment period.

Main Study

The main study was done with 50 first-grade students who were enrolled in the J.W. Reason school, Hilliard City School District, a suburb of Columbus, Ohio. There were 22 boys and 28 girls.

Parental permission forms were sent home on March 10, 1986 (Appendix G). All of the forms were returned by March 17th, 1986. This researcher had been the music specialist at this particular school for three years prior to continuing her doctoral studies at The Ohio State University. The researcher had not taught any of these first-grade students in her classroom,
however, she had taught many of their older brothers and sisters. This had a positive effect on obtaining parental permission.

The pretest was administered on March 18th and 20th, 1986. As permission had already been received from the parents concerning the research study, the students came to music knowing basically what was going to take place over the next few weeks in their music classes. The students came prepared to take the pretest. Questions from the students regarding their group placement and exactly what was going to happen were discussed after they took the pretest.

The pretest was administered by the researcher in the student's regular classroom. The students were each given an answer sheet and a crayon with which to circle their answers. The students were instructed to listen carefully and to look only at their own test paper.

The students were then instructed to listen to the directions on the pre-recorded tape and to do the practice exercises. The researcher then stopped the tape and asked if the students had any questions. The students did not have any questions at this point. The students were instructed to turn the page, listen to the
musical example, and circle the best answer. Each portion of the test took approximately fifteen minutes. The students were cooperative and listened closely while they were taking the pretest.

Design of the Study

The 50 students were divided into three groups for treatment during this study. They were paired using the results of their pretest scores and then randomly assigned into the three groups (Appendix H). The researcher did not use any other information available through the school system in the assignment of the students to their respective groups.

Group I was designated as the control group. The control group received 70 minutes per week of regular music instruction taught by the researcher rather than their own music specialist and based upon the curriculum outlined by the Hilliard City School District. Group II would participate in 50 minutes per week of the same regular music instruction, however, they would also have 20 minutes per week of special teacher-directed music activities based upon improving aural discrimination and tonal memory skills. These small group lessons would also be taught by the
Group III would have 50 minutes per week of regular classroom music instruction and 20 minutes per week of computer-assisted music instruction using the programs: *The Magic Musical Balloon* and *Toney Listens to Music*.

Arranging this schedule of music instruction in the school setting had many drawbacks. The students normally had two 35 minute sessions per week of music instruction with a music specialist. It was agreed that, for the duration of this study, the researcher could use a portion of the students' lunch period to alleviate some of the scheduling problems. The schedule was arranged so that everyone came to their regular music class time on Tuesdays. They all participated in regular music activities for 35 minutes. No mention was made during these times on Tuesdays of up/down/same or same/different.

On Thursdays everyone participated in 15 more minutes of regular classroom music activities. This was to complete the total of 50 minutes per week that each student was to be involved in regular music activities. At this point, the students in the control group (I) and the computer-assisted instruction group
groups participated in reading activities for the remaining 20 minute period. Group II students remained with the researcher to work on special music activities to increase aural discrimination and tonal memory skills. Group I, the control group, completed their last 20 minutes of music from 12:00 to 12:20 on Mondays, during their regular lunch period.

Group III, the computer-assisted instruction group, came two days a week, for ten minutes each, during their lunch period to work on the computer-assisted instruction programs. The students were actually scheduled for a 15 minute block to allow for loading the programs and activating the record keeping options. Every attempt was made to insure that the students received exactly the same amount of time involvement in music activities during each week. The schedule for this study can be seen in Table 3.

The numbers on the right hand side of Table 3 correspond to the number assigned to each individual student placed in Group III. The numbered assignment was used for all students in order to protect anonymity. A complete list of assignments is located in Appendix H.
Table 3. Music Schedule for First Grade Students

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>12:00 - 12:20</td>
<td>Group I</td>
</tr>
<tr>
<td>Tuesday</td>
<td>11:30 - 11:45</td>
<td>29 &amp; 30 Group III</td>
</tr>
<tr>
<td></td>
<td>11:45 - 12:00</td>
<td>04 &amp; 07 Group III</td>
</tr>
<tr>
<td>Thursday</td>
<td>12:00 - 12:15</td>
<td>34 &amp; 35 Group III</td>
</tr>
<tr>
<td></td>
<td>12:15 - 12:30</td>
<td>11 &amp; 12 Group III</td>
</tr>
<tr>
<td>Tuesday</td>
<td>12:50 - 1:25</td>
<td>Regular music class</td>
</tr>
<tr>
<td></td>
<td>2:45 - 3:20</td>
<td>Room 1 only</td>
</tr>
<tr>
<td>Wednesday</td>
<td>11:15</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>11:30 - 11:45</td>
<td>38 &amp; 39 Group III</td>
</tr>
<tr>
<td>Friday</td>
<td>11:45 - 12:00</td>
<td>14 &amp; 20 Group III</td>
</tr>
<tr>
<td></td>
<td>12:00 - 12:15</td>
<td>41 &amp; 48 Group III</td>
</tr>
<tr>
<td></td>
<td>12:15 - 12:30</td>
<td>22 &amp; 25 Group III</td>
</tr>
<tr>
<td>Thursday</td>
<td>12:50 - 1:05</td>
<td>Regular music class</td>
</tr>
<tr>
<td></td>
<td>1:05 - 1:25</td>
<td>Room 1 only</td>
</tr>
<tr>
<td></td>
<td>2:45 - 3:00</td>
<td>Group II from Room 1</td>
</tr>
<tr>
<td></td>
<td>3:00 - 3:20</td>
<td>Room 2 only</td>
</tr>
</tbody>
</table>

This schedule of music experiences began on March 31, 1986 and continued for eight weeks until
May 23, 1986. The posttest was administered to the students in their regular classrooms on May 27th and 29th, 1986.

**Treatment Period**

This portion of the chapter will be divided into four sections. The first section will be a discussion of the lesson plans and materials used by the researcher in the regular group music activities. These lesson plans were the actual ones implemented during the 50 minutes per week each of the students was involved in regular group music instruction. The researcher taught all of the music classes throughout the study in order to have as much control over the variables as possible.

The remaining sections will be devoted to the discussion of the twenty minute per week treatment period completed with each of the individual groups. The second section will discuss Group I (Control group), the third section will discuss Group II (Special teacher-directed activities), and the fourth section will discuss Group III (Computer-assisted instruction).
Regular Group Music Activities

Week One

The music room at the J. W. Reason school contains a large carpeted space in the center of the room. The carpet is surrounded by 30 intermediate sized chairs. The room is filled with percussion instruments, resonator bells, autoharps, some Orff instruments, a record player, tape recorder, and a piano. On the shelves can be found a variety of resource textbooks and recordings along with the Silver Burdett Music series. The music specialist at this school has decorated the room with bright colorful instructional bulletin boards. When you enter the music room, it is quite apparent that music learning is the primary goal.

The students in each of their respective groups came to music during their regularly scheduled class times. There were twenty-six students in each class. All three of the developmentally handicapped students came with their classmates in Room 1. Room 1 contained fourteen boys and twelve girls. Room 2 contained ten boys and sixteen girls.

During the course of this eight-week study, several themes were developed in these lesson plans: rhythmic
independence, form, and melodic independence. The students were engaged in a variety of musical activities including singing, moving, playing instruments, listening, creating and beginning notation. The lesson plans were designed to create a balance of these activities and to promote learning through discovery and experimentation. Lesson plans for the regular music activities can be found in Appendix I. 

During these eight weeks of regular music instruction activities, the students were cooperative and creative. After the initial lessons, the classes began to respond to the differences in teaching styles. The more they participated in the music making, the more they enjoyed the lessons. In the beginning, the students had difficulty keeping a steady beat and singing on pitch. By the end of this eight-week period the students were able to maintain a steady beat and create their own short rhythmic patterns. The students were also became much better at matching pitch and 80% of them could sing the descending minor third pattern in tune by the end of the eight-week period.

This group had limited experiences with rhythmic chanting and creating longer forms from a known
selection. They thoroughly enjoyed playing the role of the composer and making the decisions about their musical creations. The tape recorder was an invaluable tool here to help the students make those kinds of decisions.

Due to their limited experience on the Orff instruments, they were always ready to create new sounds. The students were able to play complicated rhythmic patterns quickly and easily through imitation. Many of these kinds of activities can be very time consuming when everyone needs a turn. However, the students always took an active interest in each others' creations. The discussions which followed these sound piece creations were always creative.

The Kodaly hand signs were new to these students. Because it was something they had never seen before they were extremely excited about them. You could often catch the students practicing their hand signs in the hallway or at recess. We did do a lot of echo clapping
and answering of sung questions during our music classes. This rapidly became a favorite group activity.

These students had done many folk singing games in their physical education classes. They were ready to tackle some of the intricate moves of the reel and moving to the phrase lengths. Once they had learned the singing games, there were many, many requests to repeat them.

This portion of the treatment period was shared by all as an exciting time to create and participate in music. It was apparent that learning was taking place through the improvement of the responses of the students.

GROUP I Control Group

This group of students came directly to the music room after eating their lunch. As the students entered they found a seat on the carpet in a circle. This group was comprised of ten boys and eight girls. One of the students came from the resource room. These classes were planned as an extension of the regular music class activities. Because the group of students was smaller,
each of the individuals had more time for hands on experiences. Lesson plans for the Control group can be found in Appendix J.

This group of students was more of a challenge to work with because of the mentally handicapped student. He did not like giving up his recess time and some weeks was very vocal about it. We did finally come to terms about his behavior. If this had happened a bit earlier, the students in this group would have experienced more kinds of activities. His behavior in this group was much different from his behavior with the rest of his own class. Since this group was made up of students from both homerooms, that could have been enough to make him feel uncomfortable.

The students in this group particularly seemed to enjoy the singing games and the playing of the autoharp. They were much better at keeping the beat when they were accompanying one of the singing games. More movement activities were planned for this time period due to its time slot. These students were involved in reading activities for the major portion of the morning. After lunch was traditionally a time to expend some energy so that they were ready to begin their afternoon studies.
The more each of the students could actively participate, the better the lesson. The hands on activities were always successful.

There was some learning going on during this time period, however, it was by smaller increments. The students did become much better at playing the barred instruments. However, it is quite possible that this was due to the increased exposure to the instruments.

GROUP II  Special Music Instruction

This group was comprised of only eight or nine students depending upon which homeroom was having music. This small group was created when Groups I and III were excused to the library for non-music activities on Thursdays. Room 1 contained a mixture of six girls and two boys. Room 2 had a mixture of seven girls and two boys. Since these students had already been participating in music activities prior to their small group lesson, these activities were planned as an
extension of the regular class with specific emphasis on
developing and discussing melodic direction and tonal
memory. Lesson plans for the Special music instruction
group can be found in Appendix K.

The small group setting allowed much more time for
the students to have hands on activities. Even though
the numbers of young gentlemen were small in these
groups, the boys were definitely not shy. Since one of
the specific aims of this group was to work on melodic
direction, the children were involved with many types of
visual aids. Many of these visual aids were line
drawings which represented what the students were
hearing. With a great deal of practice, many of these
students were quite capable of creating their own line
drawings and following them at the end of the eight-week
period.

The shining star of this group was the young
mentally handicapped student. She became much more
proficient in her playing skills and aural
identification skills. Because of the needed amount of
extra reinforcement and repetition that is necessary
with mentally handicapped students, she performed well during the class periods. However, there was little carry-over from week to week.

It is extremely difficult to be able to judge what each one of the students is actually hearing so that the teaching skills can be adjusted appropriately for the student to succeed in the learning experience. Even with the small groups, when one of the children gave the correct response, immediately the rest of the class stated that it was their choice also. Even though we did many melody matching games and direction games, the researcher felt that she was not adequately meeting the individual needs of the students to the fullest extent. Perhaps the time constraint as well as the great need for individual experiences became too much of a factor with this group.

The students did succeed in their identification skills of the movement of melodic fragments. At least by the end of the study they were cognizant of the terms and could apply them in certain situations. Aural discrimination skills are difficult to test except on an individual basis.
GROUP III  Computer-Assisted Instruction

Week One

Two Apple IIe microcomputers were set up daily in the regular music room for this group of young students. In order to help eliminate any distractions, the computers were positioned in such a manner that the students could not see one another. The students arrived in groups of two at fifteen minute intervals as provided by the schedule (Table 3). During the first week of the study the students were to become acquainted individually with each of the programs.

When the students arrived for the first session, the researcher loaded The Magic Musical Balloon program into the computer. Together we worked through the initial questions posed by this particular program. Each of the students was then given an opportunity to put on the headphones, listen to the sounds created by the computer program and to work through some of the practice exercises.

The students quickly and easily learned how to locate the appropriate keys in order to work through the program. The students were extremely excited about the program itself. They were quite surprised to find out
that computers could actually make musical sounds. They were also intrigued by the graphics used in The Magic Musical Balloon. For these students their ten minute time period passed much too quickly.

One of the students placed in this group was mildly mentally handicapped. The researcher did have to work one-on-one with him throughout the study. Even though he was seven-years-old, he functioned on the level of a four-year-old child. He could identify the necessary keys (U, D, and S) to work the program. However, there was some question about what he actually heard. It appeared that a lot of guessing was going on. He was, however, excited about being selected for the special computer group and this did seem to improve his self-concept and help with the rest of his school work during this eight-week time period.

During the second session of week one, the students became acquainted with the Toney Listens to Music program. The researcher loaded the program into the computer and demonstrated for the students the task at hand. They were thoroughly delighted with the character of Toney. They could hardly wait to see what he would do next if they answered correctly. Each of the
students in turn was given a chance to put on the headphones and to work through some of the musical examples in level one. The students were limited to their ten-minute total time period.

Data were not collected during the first week of the study. This first week was geared only toward familiarity with working the programs. Data collection began with the second week of the study.

For weeks two through eight of the study, the researcher set up the microcomputers in the music room and loaded The Magic Musical Balloon Game into one computer and Toney Listens to Music into the other computer. The programs were reloaded just prior to the arrival of each new pair of students. When the students arrived, one was assigned to work on The Magic Musical Balloon program and one was assigned to work on the Toney Listens to Music program. Since the students were scheduled to come twice a week they each had an opportunity to work with both of the programs once during the week.

Since the Toney Listens to Music program keeps accurate records of the student responses, the researcher designed a data sheet to keep track of the
student responses in The Magic Musical Balloon program (Appendix L). The researcher sat just to the left of the student while he was working through this particular program and checked off the appropriate response column. The data sheet was divided into three games. The students had three choices as to their response: C (correct answer on the first attempt, 2 (correct answer on the second attempt) and M (the students missed the answer). It was impossible to keep track manually of whether the students chose U for Up, D for Down or S for Same.

Data were collected on each of the students for the remaining seven weeks of this study. Since the students learned very quickly how to operate the programs, it was not necessary for the researcher to intervene in any way while the student was working with the computer. Timers were set on each computer when the student began his session. At the end of the ten-minute period the timer would ring and the student would stop working
immediately. The researcher would then reload the programs and get ready for the next pair of students.

Some of the students became very good at The Magic Musical Balloon program. Starting about week five some of the students knew what melodic fragment was coming next due to familiarity with the program. In order to make the program a bit more difficult and to ascertain whether or not the students had memorized the graphics patterns, the monitor was turned away from the students. This way the researcher could still collect the necessary data. Upon looking at the graphs of the student responses it can be seen that most of the students actually answered correctly more often on the first try when they could not view the screen. Those students who were having trouble with the program needed the visual reinforcement of the graphics. The brighter students did find it more challenging without the screen.

The only person who had to be monitored was the mentally handicapped student. Throughout the course of the study he began to understand and respond to The Magic Musical Balloon program. However, he did not
understand the terms same and different when he heard the musical examples in Toney Listens to Music. This program was very difficult for him to work with, although he did enjoy seeing Toney do his dance when he occasionally made a correct choice. From teacher observation these choices were mostly guesses. He would often choose one number and press it for the ten minute time period when he was requested to answer. He did learn to press T in order to hear Toney's melody. However, he did have to be helped with the rest of the sequence.

The criterion level was set at 70% before the student could proceed on to the next level in Toney. The results of their trials were collected and tabulated at the end of each week. The decision was then made as to which level the student would be working on during the following week. The students had the most difficulty with Level Four when their task was to compare rhythmic patterns. The data collected during the seven weeks of the study for The Magic Musical Balloon Game can be found in Appendix M.

The data collected for The Magic Musical Balloon Game does show that the students were getting
consistently better at identifying the direction of the melodic segments over the eight-week period. During the second week of the study, many of the students were finding the correct answer by the second attempt, however by the end of the eighth week, most of the students were choosing the correct answer on the first attempt. This fact can be seen by the predominance of straighter lines appearing toward the eighth week of the study. It was interesting to observe that when the graphics were removed from the student, their first attempt at the answer was almost always correct.

Appendix M also includes the individual data collected, by student, from the Toney Listens to Music program. There is a printout for each student which covers his progress throughout the study. Based upon the criterion levels set, some of the students did repeat several of the levels found in this program.

This data indicates which examples the student answered correctly by their choice of the left and right boxes as well as their percentage of correct and incorrect choices. The complete data analysis provided by this program would be extremely helpful to the teacher in planning a sequential curriculum for the
students. Based on the difficulty of the levels and the specific task covered by each of the levels, the teacher could easily supplement those areas which were more difficult for the individual student. Level seven was the highest level that could be reached due to the length of this study.
Chapter IV

ANALYSIS OF DATA

Statistical techniques were selected to provide data relevant to the question posed by this study.

Can tonal memory/aural perception skills be improved through the use of computer-assisted music instruction?

The results of these statistical techniques will be discussed in the following sequence: (1) pretest/postest scores of each individual student arranged by instructional group, (2) comparison of the mean gain scores of each individual student, (3) an analysis of variance to determine which method of instruction was the most effective, and (4) a summary of the raw data collected while the students were working on the individual computer-assisted instruction programs.
Table 4 indicates that some learning did take place within this group over the eight-week treatment period. There was some positive fluctuation of scores within this group, however, this could be attributed to the maturation process. For the majority of the students in this group their scores remained essentially the same from pretest to posttest.

<table>
<thead>
<tr>
<th>Student</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Gain Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>29</td>
<td>32</td>
<td>+3</td>
</tr>
<tr>
<td>02</td>
<td>31</td>
<td>33</td>
<td>+2</td>
</tr>
<tr>
<td>06</td>
<td>25</td>
<td>24</td>
<td>-1</td>
</tr>
<tr>
<td>08</td>
<td>44</td>
<td>47</td>
<td>+3</td>
</tr>
<tr>
<td>09</td>
<td>27</td>
<td>26</td>
<td>-1</td>
</tr>
<tr>
<td>10</td>
<td>26</td>
<td>37</td>
<td>+11</td>
</tr>
<tr>
<td>16</td>
<td>33</td>
<td>35</td>
<td>+2</td>
</tr>
<tr>
<td>21</td>
<td>35</td>
<td>36</td>
<td>+1</td>
</tr>
<tr>
<td>24</td>
<td>27</td>
<td>29</td>
<td>+2</td>
</tr>
<tr>
<td>32</td>
<td>28</td>
<td>26</td>
<td>-2</td>
</tr>
<tr>
<td>36</td>
<td>32</td>
<td>35</td>
<td>+3</td>
</tr>
<tr>
<td>42</td>
<td>28</td>
<td>33</td>
<td>+5</td>
</tr>
<tr>
<td>43</td>
<td>30</td>
<td>38</td>
<td>+8</td>
</tr>
<tr>
<td>44</td>
<td>15</td>
<td>16</td>
<td>+1</td>
</tr>
<tr>
<td>47</td>
<td>24</td>
<td>23</td>
<td>-1</td>
</tr>
<tr>
<td>49</td>
<td>22</td>
<td>25</td>
<td>+3</td>
</tr>
<tr>
<td>50</td>
<td>21</td>
<td>22</td>
<td>+1</td>
</tr>
</tbody>
</table>
Table 5. Group II Special Music Instruction

<table>
<thead>
<tr>
<th>Student</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Gain Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>35</td>
<td>27</td>
<td>-8</td>
</tr>
<tr>
<td>05</td>
<td>26</td>
<td>29</td>
<td>+3</td>
</tr>
<tr>
<td>13</td>
<td>32</td>
<td>39</td>
<td>+7</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
<td>45</td>
<td>+5</td>
</tr>
<tr>
<td>17</td>
<td>26</td>
<td>16</td>
<td>-10</td>
</tr>
<tr>
<td>18</td>
<td>26</td>
<td>36</td>
<td>+10</td>
</tr>
<tr>
<td>19</td>
<td>30</td>
<td>28</td>
<td>-2</td>
</tr>
<tr>
<td>23</td>
<td>35</td>
<td>29</td>
<td>-6</td>
</tr>
<tr>
<td>26</td>
<td>31</td>
<td>22</td>
<td>-9</td>
</tr>
<tr>
<td>27</td>
<td>19</td>
<td>23</td>
<td>+4</td>
</tr>
<tr>
<td>31</td>
<td>21</td>
<td>23</td>
<td>+2</td>
</tr>
<tr>
<td>33</td>
<td>29</td>
<td>28</td>
<td>-1</td>
</tr>
<tr>
<td>37</td>
<td>35</td>
<td>28</td>
<td>-7</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
<td>29</td>
<td>-1</td>
</tr>
<tr>
<td>45</td>
<td>27</td>
<td>38</td>
<td>+11</td>
</tr>
<tr>
<td>46</td>
<td>17</td>
<td>28</td>
<td>+11</td>
</tr>
</tbody>
</table>

This group had an extremely large difference in scores from the pretest to the posttest. This brings to mind several questions: (1) Did the students perform to the best of their ability on the pretest? (2) Were the students applying the same kind of listening skills during the posttest? (3) Was the weather on the day of the posttest a factor regarding their attention spans? (It was ninety degrees and extremely humid), and (4) Was attitude a factor during the posttest because they had
not been chosen for the computer-assisted instruction group? A detailed analysis of the individual students learning patterns and cognitive skills assessment would be helpful in determining the real cause of these large fluctuations in scores. Only in this particular group did the scores show such a wide discrepancy.

The researcher did observe that students number 18, 45 and 46 worked very hard in their special music classes. All three of these students showed a real eagerness to learn. Students number 3 and 37 were absent for over one-half of the lessons which could explain the difference in their scores from pretest to posttest. Student number 26 had his birthday on the day of the posttest. Given the developmental characteristics of young children, student number 26 was perhaps concentrating on the day's forthcoming celebrations. Student number 17 had a great deal of difficulty perceiving aural sounds and responding correctly during the special music classes. For this particular student a one-on-one pretest and posttest would probably yield more accurate results.
Table 6. Group III Computer-Assisted Instruction

<table>
<thead>
<tr>
<th>Student</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Gain Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>35</td>
<td>47</td>
<td>+9</td>
</tr>
<tr>
<td>07</td>
<td>37</td>
<td>39</td>
<td>+2</td>
</tr>
<tr>
<td>11</td>
<td>22</td>
<td>22</td>
<td>+0</td>
</tr>
<tr>
<td>12</td>
<td>26</td>
<td>28</td>
<td>+2</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>31</td>
<td>+6</td>
</tr>
<tr>
<td>20</td>
<td>31</td>
<td>34</td>
<td>+3</td>
</tr>
<tr>
<td>22</td>
<td>30</td>
<td>29</td>
<td>-1</td>
</tr>
<tr>
<td>25</td>
<td>26</td>
<td>26</td>
<td>+0</td>
</tr>
<tr>
<td>28</td>
<td>19</td>
<td>25</td>
<td>+6</td>
</tr>
<tr>
<td>29</td>
<td>28</td>
<td>35</td>
<td>+7</td>
</tr>
<tr>
<td>30</td>
<td>27</td>
<td>28</td>
<td>+1</td>
</tr>
<tr>
<td>34</td>
<td>32</td>
<td>40</td>
<td>+8</td>
</tr>
<tr>
<td>35</td>
<td>33</td>
<td>35</td>
<td>+2</td>
</tr>
<tr>
<td>36</td>
<td>42</td>
<td>44</td>
<td>+2</td>
</tr>
<tr>
<td>39</td>
<td>30</td>
<td>31</td>
<td>+1</td>
</tr>
<tr>
<td>41</td>
<td>23</td>
<td>32</td>
<td>+9</td>
</tr>
<tr>
<td>48</td>
<td>30</td>
<td>39</td>
<td>+9</td>
</tr>
</tbody>
</table>

This group showed a positive growth in scores from pretest to posttest consistently among the group. Since this group did have a consistent positive growth from pretest to posttest and did not have the large fluctuation of scores, the results seem to indicate that tonal memory/aural perception skills can be improved through the use of computer-assisted instruction when it is used as a supplemental tool. It appears that the
computer-assisted instruction group was more consistent in their assimilation of the material being presented.

Table 7. Means and Standard Deviations

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th></th>
<th>Posttest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>I</td>
<td>28.0588</td>
<td>6.15</td>
<td>30.4118</td>
<td>7.32</td>
</tr>
<tr>
<td>II</td>
<td>28.6875</td>
<td>6.03</td>
<td>29.2500</td>
<td>6.99</td>
</tr>
<tr>
<td>III</td>
<td>29.1765</td>
<td>5.55</td>
<td>33.2353</td>
<td>6.66</td>
</tr>
</tbody>
</table>

Data from the means and standard deviations were used for further statistical analyses.

Analysis of Variance

An analysis of variance was executed in order to compare the effectiveness of the three approaches on the improvement of aural perception/tonal memory skills. The results are stated in Table 8.
Table 8. Analysis of Variance

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>28.0588</td>
<td>28.6875</td>
<td>29.1765</td>
</tr>
<tr>
<td>Postest</td>
<td>30.4118</td>
<td>29.2500</td>
<td>33.2353</td>
</tr>
<tr>
<td>df</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equality of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted Means</td>
<td>2</td>
<td>104.8141</td>
<td>2.0885</td>
</tr>
<tr>
<td>Zero Slope</td>
<td>1</td>
<td>1293.8997</td>
<td>51.5642</td>
</tr>
<tr>
<td>Error</td>
<td>46</td>
<td>1154.2767</td>
<td></td>
</tr>
<tr>
<td>Equality of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slopes</td>
<td>2</td>
<td>110.6293</td>
<td>2.3321</td>
</tr>
<tr>
<td>Error</td>
<td>44</td>
<td>1043.6474</td>
<td></td>
</tr>
<tr>
<td>Probabilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for T-Values</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>.3348</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>.2854</td>
<td>.0489</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

The results of this analysis indicated a non-significant F value. Factors which might have affected this analysis could have been: (1) the small number of
subjects within each group (Group I = 17, Group II = 16, and Group III = 17), (2) the large fluctuations of scores found in Group II between the pretest and the posttest, and (3) the narrow difference between the means which were found as a result of pretest. If the study had been longer perhaps the results would have been statistically significant between the different instructional treatment groups.

Computer-Assisted Instruction Individual Data

Table 9 is a summary of the data collected in The Magic Musical Balloon Game. The number of students who answered each question correctly on the first attempt only was tabulated to create this graph. This tabulation was done for each of the seven weeks in which data was collected. The graphs were then superimposed to show the improvement of the students as a group from the beginning to the end of the treatment period. The individual raw data which was collected can be found in Appendix M.
Table 9. **Magic Musical Balloon Game Data**

This graph represents the number of correct answers for each segment of the melody which occurred on the first attempt to answer only.

- The dotted line represents week two.
- The solid line represents week eight.
It can easily be noted from this graph that the students did improve during the treatment period. The dotted line on the graph represents the number of correct answers on the first attempt for each melodic segment of The Magic Musical Balloon Game program for all of the students during the second week of the study. The solid line represents the number of correct answers scored by the students during the eighth week of the study. As the weeks progressed at least 10 of the 16 students in this group were answering each melodic segment question correctly on their first attempt. It should also be noted that the students were able to finish The Magic Musical Balloon Game program during the allotted time period by the end of the treatment period.

The dips made by this graph indicate that the students frequently had more trouble with the final segment (number 4) of each of the presented melodies. The graph also indicates that the students had more trouble toward the end of Games 1 and 2. This could be explained by fatigue due to the intense concentration required during each individual game segment.

The Toney Listens to Music program was designed to improve the auditory discrimination skills of its users
by means of a sequential set of tasks ranging from simple to complex. The musical concepts used to reach this goal included the areas of melodic motion, interval size, tempo, timbre and rhythmic patterns. The levels in this program, however, are not arranged by increasing difficulty. The raw data collected by this program can be found in Appendix M. Table 10 indicates the percentage of students who answered each question correctly. The percentages are arranged by levels and the number of each question posed by the Toney program.
These percentages of correct answers indicate that levels four and six were the most difficult for the students. Level four was labeled by the programmers as easy rhythm patterns. The patterns were presented in a
meter of four/four and were comprised of half notes, quarter notes, dotted quarter notes, and eighth notes. The patterns did not contain any rests. The contrasting rhythms heard in this level were different patterns using the same rhythmic values. These examples also did not contain any rests. The title of this level indicates that the patterns contained a large contrast in their arrangement of rhythmic values. The students commented that this was the most difficult level for them. This could pertain to the material in this level and its connection to classroom activities. Perhaps the curriculum should include more rhythmic aural discrimination skills.

Level six contained small interval sizes. Toney played intervals which could move up, down or stay the same. The contrasting interval was one which moved in the same direction as Toney's, however, it played a different interval size utilizing a minor third or less.

The levels which utilized familiar melodies (Levels 1 and 5), pitch motion (Level 2), large interval
size (level 3), and tempo (Level 7) were much easier for the students to discriminate.

Table 10 is a little deceiving in that it does not indicate the number of students who attempted each level. The number of students who did attempt each level of the Toney program were: Level one (17), Level two (17), Level three (16), Level four (16), Level five (15), Level six (13), and Level seven (8). This is an indication that some of the students did not reach the criterion level during their first encounter with each level. One-half of the students did repeat at least one level during the course of the treatment period. The exceptional student could only meet the criteria level set for Level one. His attempts at Level two were very difficult and discouraging for him.
CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

The purpose of this study was to determine the effect of computer-assisted music instruction, when used as a supplemental tool, on the development of tonal memory skills and the aural perception of melodic movement (up/down/same) with first grade students. The specific question addressed in his study was:

Can tonal memory/aural perception skills be improved through the use of computer-assisted music instruction?

The 50 first-grade students who participated in this study were from a local school district which had a full time music specialist. Initially, the researcher designed a pretest, which went through two revisions, in order to measure the students' knowledge of melodic direction and tonal memory. The students were then given the final version of the researcher-designed pretest. From their pretest scores, the students were paired and then randomly assigned into one of the three
instructional groups: Control (I), Special (II), and Computer-assisted instruction (III) for the eight week treatment period.

Group I was designated as the control group. The control group received 70 minutes per week of regular classroom music instruction taught by the researcher and based upon the curriculum outlined by the Hilliard City School District. Group II participated in 50 minutes per week of the same regular music instruction and 20 minutes per week of special teacher-directed music activities based upon the improvement of tonal memory and aural discrimination skills. These small group lessons were also taught by the researcher. Group III participated in 50 minutes per week of the same regular music instruction and 20 minutes per week of computer-assisted music instruction using the programs: The Magic Musical Balloon Game and Toney Listens to Music.

Upon completion of the treatment period the students were retested using the researcher-designed
pretest/posttest. Statistical techniques were then selected to analyze the data relevant to the question posed by this study.

Therefore, based upon the data collected and the applied statistical procedures, the following findings are presented:

1. The first-grade students did understand the concepts of melodic direction (up/down/same) and tonal memory (same/different).

2. The mean gain scores indicated that tonal memory/aural discrimination skills can be improved through maturation, small group instruction, and computer-assisted instruction.

3. The mean gain scores indicated that the computer-assisted instruction group had the most consistent growth from the pretest to the posttest.

4. The analysis of variance indicated that none of the instructional procedures used during this study was a more effective method for the teaching of tonal memory/aural discrimination skills.
Conclusions

Based upon the findings, parameters and limitations of the present study, the following conclusions were drawn:

1. A valid and reliable test was developed to measure first-grade students auditory perception of melodic direction and tonal memory.

2. Tonal memory/aural perception skills can be improved through the supplemental use of computer-assisted instruction in the elementary music classroom.

3. First-grade students have the most difficulty with the aural perception of rhythmic patterns and intervals which are only a minor third apart in size.

4. This study was unique in that it studied the use of computer-assisted instruction as a supplemental tool with first-grade students.

Recommendations for Further Research

Since this study was an initial investigation into the supplemental use of computer-assisted instruction in the elementary music classroom, further documented research seems to be warranted. This study does indicate that tonal memory/aural perceptions skills can be improved through the use of computer-assisted music
instruction programs. Further research is needed in this area to develop good curricular software programs and their applications to current teaching trends.

Recommendations for further research are:

1. Subsequent research should be conducted over a longer period of time utilizing larger numbers of students.

2. A delayed posttest should be administered in order to test for any retention of the aural perception skills.

3. The pretest and postest should be given on an individual basis to obtain a more accurate description of each student's current level of functioning.

4. An attitude scale should be developed to ascertain the students' impressions of the computer-assisted instruction.

5. Additional studies should be done with different conceptually based software programs at different age levels in order to substantiate the use of computer-assisted instruction as a supplemental tool in the music classroom.
Appendix A

Requests for Information Regarding Software
ALF Products
1315F Nelson Street
Denver, Colorado 80215

Alfred Publishing
15335 Morrison Street
P.O. Box 5964
Sherman Oaks, California 91413

Auricle Control Systems
3828 Woodciffs Road
Sherman Oaks, California 91403

Computer Applications Tomorrow (C.A.T.)
24151 Telegraph Road
Southfield, Michigan 48034

Conduit
The University of Iowa
Oakdale Campus
Iowa City, Iowa 52242

Educational Courseware
67A Willard Street
Hartford, Connecticut 06195

Electronic Courseware Systems (ECS)
1210 Lancaster Drive
Champaign, Illinois 61821

Maestro Music
2403 San Mateo NE
Suite P-6
Albuquerque, New Mexico 87110

Mastersoft
P.O. Box 1027
Bend, Oregon 97709

Micro Technology Unlimited
2806 Hillsborough Street
Raleigh, North Carolina 27605

Minnesota Educational Computing Corporation (MECC)
3490 Lexington Avenue North
St. Paul, Minnesota 55112
Mountain Computer
300 El Pueblo
Scotts Valley, California  95066

National Consortium for Computer-Based Music Instruction
NCCBMI
Michael Arenson
Department of Music
University of Delaware
Newark, New Jersey  19716

Notable Software
P.O. Box 1556
Philadelphia, Pennsylvania  19105

NTSU Music CAI Software
School of Music
North Texas State University
Denton, Texas  76203

Passport Designs
625 Miramontes Street
Suite 103
Half Moon Bay, California  94019

Roland Corporation US
7200 Dominion Circle
Los Angeles, California  90040

Sequential Circuits
3051 North First Street
San Jose, California  95134-2093

Silver Burdett
250 James Street
Morristown, New Jersey  07960

Software Affair
858 Rubis Drive
Sunnydale, California  94087

Software for Arts Education
9339 South 500E
Provo, Utah  84601
Springboard Software Incorporated  
7807 Creekridge Circle  
Minneapolis, Minnesota  55435

Sterling Swift Publishing  
7091 South I-35  
Austin, Texas  78744

Sweetmicro Systems  
50 Freeway Drive  
Cranston, Rhode Island  02910

Syntauri Corporation  
4962 El Camino Real  
Suite 112  
Los Altos, California  94022

Temporal Acuity Products (TAP)  
Building 1  
Suite 200  
300-120th Avenue N.E.  
Bellevue, Washington  98005

Wadsworth Publishing  
10 Davis Drive  
Belmont, California  94002

Waveform Corporation  
1912 Bonita Way  
Berkeley, California  94704

Wenger Corporation  
P.O. Box 448  
Owatonna, Minnesota  55060-0448
Appendix B

Sample Answer Sheets Used in Pilot Study I
<table>
<thead>
<tr>
<th>1</th>
<th>UP</th>
<th>DOWN</th>
<th>SAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>UP</td>
<td>DOWN</td>
<td>SAME</td>
</tr>
<tr>
<td>3</td>
<td>UP</td>
<td>DOWN</td>
<td>SAME</td>
</tr>
<tr>
<td>4</td>
<td>UP</td>
<td>DOWN</td>
<td>SAME</td>
</tr>
<tr>
<td>5</td>
<td>UP</td>
<td>DOWN</td>
<td>SAME</td>
</tr>
</tbody>
</table>
A

SAME

DIFERENT

B

SAME

DIFERENT
Appendix C

Pilot Study I

Script and Musical Examples
SCRIPT FOR PILOT STUDY I - PRETEST A

You are about to hear some melodies. For each melody you hear, circle the BEST answer. If the melody you hear is moving up, circle the rocket. If the melody you hear is moving down, circle the leaves. If the melody you hear stays the same, circle the fence.

Put your finger on the letter A. Listen to the melody. (Play Ex. A) Circle your answer. (8 seconds) You should have circled the rocket because the melody was moving up. Listen to melody A again. (Play Ex. A)

Now, put your finger on the letter B. Listen to the melody. (Play Ex. B) Circle your answer. (8 seconds) You should have circled the fence because the melody stayed the same. Listen to melody B again. (Play Ex. B)

Now, put your finger on the letter C. Listen to the melody. (Play Ex. C) Circle your answer. (8 seconds) You should have circled the leaves because the melody was moving down. Listen to melody C again. (Play Ex. C)

Turn the page and put your finger on the number 1. Listen to the melody and circle the best answer.

Number 1 (Play #1) (8 seconds)
Number 2 (Play #2) (8 seconds)
Number 3 (Play #3) (8 seconds)
Number 4 (Play #4) (8 seconds)
Number 5 (Play #5) (8 seconds)
Number 6 (Play #6) (8 seconds)
Number 7 (Play #7) (8 seconds)
Number 8 (Play #8) (8 seconds)
Number 9 (Play #9) (8 seconds)
Number 10 (Play #10) (8 seconds)
Number 11 (Play #11) (8 seconds)
Number 12 (Play #12) (8 seconds)
Number 13 (Play #13) (8 seconds)
Number 14 (Play #14) (8 seconds)
Number 15 (Play #15) (8 seconds)
You are about to hear some melodies. For each example you will hear two short melodies. If the melodies you hear are the same, circle the fences. If the melodies you hear are different, circle the picture of the rocket and the leaves.

Put your finger on the letter A. Listen to both of the melodies. (Play Ex. A) Circle your answer. (8 seconds) You should have circled the fences because both melodies were the same. Listen to the melodies again. (Play Ex. A)

Now, put your finger on the letter B. Listen to both of the melodies. (Play Ex. B) Circle your answer. (8 seconds) You should have circled the picture of the rocket and the leaves because these melodies were different. Listen to the melodies again. (Play Ex. B)

Turn the page and put your finger on the number 1. Listen to both melodies and then circle the BEST answer.

Number 1  (Play #1)  (8 seconds)
Number 2  (Play #2)  (8 seconds)
Number 3  (Play #3)  (8 seconds)
Number 4  (Play #4)  (8 seconds)
Number 5  (Play #5)  (8 seconds)
Number 6  (Play #6)  (8 seconds)
Number 7  (Play #7)  (8 seconds)
Number 8  (Play #8)  (8 seconds)
Number 9  (Play #9)  (8 seconds)
Number 10  (Play #10)  (8 seconds)
Appendix D

Revised Answer Sheet for Pilot Study II
<table>
<thead>
<tr>
<th>DIFFERENT</th>
<th>SAME</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Different" /></td>
<td><img src="image2.png" alt="Same" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIFFERENT</th>
<th>SAME</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Different" /></td>
<td><img src="image4.png" alt="Same" /></td>
</tr>
</tbody>
</table>

B

A

243
<table>
<thead>
<tr>
<th>1</th>
<th>SAME</th>
<th>DIFFERENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>SAME</td>
<td>DIFFERENT</td>
</tr>
<tr>
<td>3</td>
<td>SAME</td>
<td>DIFFERENT</td>
</tr>
<tr>
<td>4</td>
<td>SAME</td>
<td>DIFFERENT</td>
</tr>
<tr>
<td>5</td>
<td>SAME</td>
<td>DIFFERENT</td>
</tr>
</tbody>
</table>
Appendix E

Pilot Study II
Script and Music Examples
SCRIPT FOR PILOT STUDY II - PRETEST A

You are about to hear some melodies. For each melody you hear, circle the BEST answer. If the melody you hear is moving up, circle the rocket. If the melody you hear is moving down, circle the leaves. If the melody you hear stays the same, circle the fence.

Put your finger on the letter A. Listen to the melody. (Play Ex. A) Circle your answer. (10 seconds) You should have circled the rocket because the melody was moving up. Listen to melody A again. (Play Ex. A)

Now, put your finger on the letter B. Listen to the melody. (Play Ex. B) Circle your answer. (10 seconds) You should have circled the fence because the melody stayed the same. Listen to melody B again. (Play Ex. B)

Now, put your finger on the letter C. Listen to the melody. (Play Ex. C) Circle your answer. (10 seconds) You should have circled the leaves because the melody was moving down. Listen to melody C again. (Play Ex. C)

Turn the page and put your finger on the number 1. Listen to the melody and circle the best answer.

Number 1 (Play #1) (10 seconds)
Number 2 (Play #2) (10 seconds)
Number 3 (Play #3) (10 seconds)
Number 4 (Play #4) (10 seconds)
Number 5 (Play #5) (10 seconds)
Number 6 (Play #6) (10 seconds)
Number 7 (Play #7) (10 seconds)
Number 8 (Play #8) (10 seconds)
Number 9 (Play #9) (10 seconds)
Number 10 (Play #10) (10 seconds)
Number 11 (Play #11) (10 seconds)
Number 12 (Play #12) (10 seconds)
Number 13 (Play #13) (10 seconds)
Number 14 (Play #14) (10 seconds)
Number 15 (Play #15) (10 seconds)
Number 16 (Play #16) (10 seconds)
Number 17 (Play #17) (10 seconds)
Number 18 (Play #18) (10 seconds)
Number 19 (Play #19) (10 seconds)
Number 20 (Play #20) (10 seconds)
Number 21 (Play #21) (10 seconds)
Number 22 (Play #22) (10 seconds)
Number 23 (Play #23) (10 seconds)
Number 24 (Play #24) (10 seconds)
Number 25 (Play #25) (10 seconds)
SCRIPT FOR PILOT STUDY II - PRETEST B

You are about to hear some melodies. For each example you will hear two short melodies. If the melodies you hear are the same, circle the fences. If the melodies you hear are different, circle the picture of the fence and the leaves.

Put your finger on the letter A. Listen to both of the melodies. (Play Ex. A) Circle your answer. (10 seconds) You should have circled the fences because both melodies were the same. Listen to the melodies again. (Play Ex. A)

Now, put your finger on the letter B. Listen to both of the melodies. (Play Ex. B) Circle your answer. (10 seconds) You should have circled the picture of the fence and the leaves because these melodies were different. Listen to the melodies again. (Play Ex. B) (10 seconds)

Turn the page and put your finger on the number 1. Listen to both melodies and then circle the BEST answer.

Number 1  (Play #1)  (10 seconds)
Number 2  (Play #2)  (10 seconds)
Number 3  (Play #3)  (10 seconds)
Number 4  (Play #4)  (10 seconds)
Number 5  (Play #5)  (10 seconds)
Number 6  (Play #6)  (10 seconds)
Number 7  (Play #7)  (10 seconds)
Number 8  (Play #8)  (10 seconds)
Number 9  (Play #9)  (10 seconds)
Number 10 (Play #10) (10 seconds)
Number 11 (Play #11) (10 seconds)
Number 12 (Play #12) (10 seconds)
Number 13 (Play #13) (10 seconds)
Number 14 (Play #14) (10 seconds)
Number 15 (Play #15) (10 seconds)
Number 16 (Play #16) (10 seconds)
Number 17 (Play #17) (10 seconds)
Number 18 (Play #18) (10 seconds)
Number 19 (Play #19) (10 seconds)
Number 20 (Play #20) (10 seconds)
Number 21 (Play #21) (10 seconds)
Number 22 (Play #22) (10 seconds)
Number 23 (Play #23) (10 seconds)
Number 24 (Play #24) (10 seconds)
Number 25 (Play #25) (10 seconds)
Pretest B  
Same-Different

Example A

1.

Example B

2.

3.
Appendix F

Musical Examples Pretest/Posttest
Appendix G

Parental Permission Form
Dear Parents:

I would like to request permission for your child to participate in a doctoral research study which will be conducted at his school during the regular school day. This study pertains to the use of computer-assisted instruction when it is used as a supplemental tool in the elementary music classroom.

The first grade students will be given a pretest to measure their knowledge of how melodies move (up, down, same) and their level of tonal memory. After the pretest, the students will be paired randomly and divided into three groups. All three groups will receive the same amount of music instruction during the week. They will however, be involved in different kinds of music activities.

The instruction during these music classes will focus on the development of melodic concepts. One of the three groups of students will receive twenty minutes per week of computer-assisted music instruction.

At the end of the eight week period, the students will be given a posttest to determine whether or not the computer-assisted music instruction programs did enhance the learning which was already taking place in the music classroom.

The names of the students involved in this study will not be used in any way by the researcher. If you have any questions or you would like to see the pretest/posttest, please contact me at 236-1498. Please sign and return the form below as soon as possible.

Thank you in advance for your cooperation.

Sincerely,

Sandra K. Whiston
Doctoral Candidate
The Ohio State University

I give my approval for __________________________ to participate in this music research study.

Parent's signature: __________________________ Date: _______
Appendix H

Paired Assignment to Groups for Treatment Period
## Assignment to Groups for Treatment Period

<table>
<thead>
<tr>
<th># Correct</th>
<th>Student</th>
<th>Group Assignment</th>
<th>Moved</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>08</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>38</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>15</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>07</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>51</td>
<td>Control (I)</td>
<td>moved</td>
</tr>
<tr>
<td>35</td>
<td>37</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>23</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>21</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>04</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>03</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>35</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>18</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>36</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>34</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>13</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>02</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>20</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>26</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>39</td>
<td>CAI (III)</td>
<td>moved</td>
</tr>
<tr>
<td>30</td>
<td>52</td>
<td>Control (I)</td>
<td>moved</td>
</tr>
<tr>
<td>30</td>
<td>19</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>48</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>43</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>40</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>22</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>01</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>33</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>42</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>32</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>29</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Number</td>
<td>Group</td>
<td>Notes</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td>27</td>
<td>24</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>30</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>45</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>09</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>25</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>18</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>10</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>12</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>17</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>05</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>06</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>14</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>47</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>41</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>53</td>
<td>Special (II)</td>
<td>moved</td>
</tr>
<tr>
<td>22</td>
<td>49</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>11</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>31</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>50*</td>
<td>Control (I)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>27*</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>28*</td>
<td>CAI (III)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>46</td>
<td>Special (II)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>44</td>
<td>Control (I)</td>
<td></td>
</tr>
</tbody>
</table>

* denotes mentally handicapped - resource room
Appendix I

Behavioral Objectives

Regular Fifty-Minute Music Classes
Week One

Tuesday April 1, 1986

35 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat by a patschen and echo their classmates names in rhythm.

3. The students will be able to listen and follow the directions in Hap Palmer's *Put Your Hands Up In The Air*.

4. The students will be able to mirror the teacher's movements to the beat of *Put Your Hands Up In The Air*.

5. The students will be able to sing in tune *How D'Ye Do and Shake Hands* (*The Music Book*, Grade 1, page 4).

6. The students will be able to state in rhythm "My name is ______, How do you do" when it occurs in *How D'Ye Do and Shake Hands*.

7. The students will be able to strum their imaginary guitar along with the teacher while they are singing *How D'Ye Do and Shake Hands*.

8. The students will be able to position their hands correctly for the Kodaly signs of Sol and Mi.

9. The students will be able to sing in tune the descending minor third of Sol-Mi while moving their hands.
Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat by a patschen and echo their classmates' names imitating the teacher's vocal inflection.

3. The students will be able to say in rhythm the chant I've Got the Beat. (Orff Workshop materials)

4. The students will be able to move the appropriate body parts to accompany the rhythmic chant I've Got the Beat.

5. The students will be able to play a steady drum beat to accompany the class while they repeat the rhythmic chant.

Week Two

Tuesday April 8, 1986 35 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 2/4. The rhythm pattern / / /7 / will be emphasized.

2. The students will be able to keep a steady beat by a soft clap and echo their classmates' names in rhythm.

3. The students will be able to make the appropriate hand signs to accompany Sol and Mi.
4. The students will be able to move their hands on the Sol-Mi pitches heard in *Rain, Rain Go Away*.

5. The students will be able to sing in tune the song *Rain, Rain Go Away*.

6. The students will be able to hold up visual aids (A & B) to identify the different sections in *Clap Your Hands* (*Music, grade 1, page 96, record 5, band 6*). Form = AB

7. The students will be able to locate the rhythmic pattern / / /7 / in the A section of *Clap Your Hands*.

8. The students will be able to use the rhythmic pattern / / /7 / as an ostinato during the A section of *Clap Your Hands* while listening to the recording.

9. The students will be able to identify the timbre of the tambourine in the B section of *Clap Your Hands*.

10. The students will be able to play the rhythmic pattern / / /7 / of the tambourine on the tambourine to accompany the B section of *Clap Your Hands*.

11. The students will create a movement to demonstrate what they hear rhythmically in the A section of *Clap Your Hands*. 
Thursday April 10, 1986 15 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter on 4/4.

2. The students will be able to tap a steady beat while echoing their classmates names using the Sol-Mi pitches.

3. The students will be able to sing in tune Rain, Rain Go Away.

4. The students will be able to show through movement the ABA form of The Elephant song. (Music, grade 1, record 5, band 7).

5. The students will be able to identify the timbre of the guitar in The Elephant song.

6. The students will be able to move their feet with the beat played by the guitar in The Elephant song. Slow-Fast-Slow.

Week Three

Tuesday, April 15, 1986 35 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat by a patschen while echoing their classmates names on the pitches Sol-Mi.

3. The students will be able to say in rhythm the chant Fold in the Middle. (Helen Kemp Workshop). This is rhythmic chant to improve posture prior to singing.
4. The students will be able to sing in tune Rain, Rain Go Away.

5. The students will able to use the Sol-Mi and La hand signals to accompany the singing of Rain, Rain Go Away.

6. The students will be able to alternate their hands (left hand touches thigh, right hand touches thigh) to keep a steady beat while singing Rain, Rain Go Away.

7. The students will be able to play octave G’s on the bass xylophone (Left-right alternation) to accompany the singing of Rain, Rain Go Away.

8. The students will be able to sing the song Rain, Rain Go Away - think it - and then sing it again to create an ABA form.

9. The students will be able to create a rain sound on the soprano glockenspiel to fill in the B section of our new ABA form. The students will only be given the pitches found in a pentatonic scale.

10. The students will create a movement to demonstrate the rain sounds created in the B section of our new composition.

Thursday April 17, 1986 15 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat while singing their classmates names on the pitches Sol-Mi.
3. The students will be able to say the rhythmic chant Fold in the Middle in the correct rhythm.

4. The students will sing Rain, Rain Go Away in tune using the appropriate Kodaly hand signs for Sol-Mi and La.

5. The students will create a rhythmic rain storm using stamps, patschen, claps and snaps. The students will be guided by the teacher to create a crescendo and decrescendo to imitate soft rain - thunderstorm - soft rain.

6. The students will be able to incorporate their rhythmic rainstorm into their ABA form of singing Rain, Rain Go Away.

Week Four:

Tuesday, April 21, 1986 35 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat while echoing their classmates names on the pitches Sol-Mi.

3. The students will be able to chant Fold in the Middle using the correct rhythm.

4. The students will be able to create a rhythmic sound piece using selected non-pitched percussion instruments. The students will be able to use the concept of crescendo/decrescendo and work within a 4/4 meter.
5. The students will listen to the "thunderstorm" portion of Grofe's Grand Canyon Suite and manipulate a scarf to show the crescendo/decrescendo.

6. The students will be able to sing in tune the song Shoo Fly (Music, grade 2, page 39). Form = ABA

7. The students will be able to perform the dance to Shoo Fly while singing the song.

8. The students will be able to play the octave C pitches on the alto xylophone (alternating left, right) to accompany the singing of Shoo Fly.

Thursday, April 23, 1986 15 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat while echoing their names on the pitches Sol-Mi.

3. The students will be able to individually sing the Sol-Mi pitch pattern using the Kodaly hand signs.

4. The students will be able to sing in tune the song Lucy Locket (Music, grade 1, Kodaly Curriculum Guide, page 44).

5. The students will be able to use the appropriate Kodaly hand signs (Sol-Mi and La) while they are singing Lucy Locket.
Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to create a short rhythmic pattern using a meter of 4/4 and lead the class in performing their pattern.

3. The students will be able to echo the phrase "I have found your pocket" using the pitches Sol-La-Sol-Mi in tune and rhythmically correct.

4. The students will be able to sing Lucy Locket in tune while keeping a steady beat.

5. The students will be able to participate in the singing game of Lucy Locket.

6. The students will be able to pass Lucy Locket's pocket on the beat while singing the song.

Behavioral objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to echo short melodic phrases sung by the teacher using only the Sol-Mi pattern while keeping a steady beat.
3. The students will be able to say the nursery rhyme Jack Be Nimble using the correct rhythm and vocal inflections.

4. The students will be able to create a vocal crescendo to help Jack get over his candlestick.

5. The students will be able to play a crescendo using either a drum or a tambourine while chanting Jack Be Nimble.

6. The students will be able to chant Jack Be Nimble in ABA form.

Week Six

Tuesday, May 6, 1986 35 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to lead the class in performing a short rhythmic phrase based on a meter of 4/4.

3. The students will be able to answer individually sung questions by the teacher using only the pitches of Sol and Mi.

4. The students will be able to sing in tune the teacher’s own version of Skip To My Lou.

5. The students will stand on the I chord and sit on the V chord while the teacher plays the song Skip to My Lou on the autoharp.
6. The students will strum their imaginary autoharps to the beat while singing *Skip to My Lou*.

7. The students will be able to perform the square dance movements while singing *Skip to My Lou*.

Thursday, May 8, 1986

15 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to lead the class in performing a short rhythmic phrase based on a meter of 4/4.

3. The students will be able to strum the autoharp on the beat while accompanying the singing of *Skip to My Lou*.

4. The students will be able to work in pairs of two using the autoharp and changing chords. One student will strum while the other presses the appropriate chord buttons changing from I to V at the correct point in the song *Skip to My Lou*.

Week Seven

Tuesday, May 13, 1986

35 minute period

No class due to an all day field trip.
Thursday, May 15, 1986 15 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a steady beat by a patschen while echoing their classmates names on the pitches Sol-Mi.

3. The students will listen to the recording The Wind Up Toy Factory (recording by Kathy Poelker) and describe what they hear happening in the music.

4. The students will be able to work in pairs to demonstrate the movements suggested by the music The Wind Up Toy Factory. The toy is wound up, he moves to the beat and then slows down as the spring loosens.

Week Eight

Tuesday May 20, 1986 35 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to lead the class in performing a short rhythmic phrase based on a meter of 4/4.

3. The students will be able to answer individually sung questions by the teacher using only the pitches of Sol and Mi.

4. The students will be able to sing the song Bow Belinda in tune. (Integrating Music into the Classroom).
5. The students will be able to tap a steady beat while they sing *Bow Belinda*.

6. The students will be able to raise their hand when they hear the phrase that is different "Won't you be my darling?" in *Bow Belinda*.

7. The students will be able to identify the four phrases in the song *Bow Belinda*. They will raise their hand at the beginning of each phrase.

8. The students will be able to perform the square dance movements while singing *Bow Belinda*.

**Thursday, May 22, 1986.** 15 minute period

**Behavioral Objectives:**

1. The students will be able to use their voices to help the teacher read and sing *The Foolish Frog* by Pete Seeger.

2. The students will be able to sing in tune the A section of the song *The Foolish Frog*.

3. The students will be able to discuss the form (AB) of the song *The Foolish Frog*.

4. The students will be able to use their voices to create the appropriate sounds for each of the characters created in this book.
Appendix J

Behavioral Objectives

Control Group - Twenty Minute Music Class
Week One

Monday, March 31, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a beat by a patschen and echo their classmates names in rhythm.

3. The students will be able to sing in tune Old MacDonald Had A Farm *Music, grade K, Page 13*.

4. The students will be able to create new verses for Old MacDonald Had a Farm.

5. The students will each take a practice strum on the autoharp with a partner holding down one of the buttons.

6. The students will practice playing their imaginary autoharps in preparation for playing the I and V chords to accompany the singing of Old MacDonald Had A Farm.

---

Week Two

Monday, April 7, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 4/4.

2. The students will be able to keep a soft steady clap and echo their own name in rhythm.
3. The students will be able to sing *Old MacDonald* in tune while strumming their imaginary autoharps.

4. The students will be able to accompany the chorus of *Old MacDonald* using the I and V chords.

5. The students will be able to imitate the rhythmic patterns heard in *Come Play the Stick Game* (Educational Activities record).

6. The students will be able to repeat the rhythmic chant to accompany the playing of the rhythm sticks in *Come Play the Stick Game*.

7. The students will be able to play a steady beat on the rhythm sticks while they are chanting *Come Play the Stick Game*.

8. The students will be able to play a short rhythmic pattern on their own rhythm sticks for the class to imitate.

---

**Week Three**

**Monday, April 14, 1986**

20 minute period

**Behavioral Objectives:**

1. The students will be able to echo clap short phrases based on a meter of 2/4.

2. The students will be able to keep a soft steady clap and echo their own name in rhythm.

3. The students will be able to echo the chant *Oliver Twist* in a 2/4 meter (*Music*, grade 1, page 129).
4. The students will be able to move the appropriate body parts to accompany the chant *Oliver Twist* and feel the beats moving in sets of two.

5. The students will be able to move their hand on the chart (Music, grade 1, page 132) to show steady beats moving in a meter of two while the class chants *Oliver Twist*.

6. The students will listen to Shostakovich "March" from *Six Pieces for Children* and move demonstrating the steady beat.

7. The students will play a steady beat on their rhythm sticks.

**Week Four**

Monday, April 21, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 2/4.

2. The students will be able to keep a soft steady clap and echo their own name in rhythm.

3. The students will be able to sing in tune the song *Pass The Shoe* (*Music, grade K, page 95*).

4. The students will be able to clap on the first beat of every measure while singing *Pass The Shoe*. 
5. The students will be able to pass their own shoes on the first beat of every measure while singing Pass The Shoe.

6. The students will be able to play their drums with the steady beat while listening to Stars and Stripes Forever by Sousa.

Week Five

Monday April 28, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 2/4.

2. The students will be able to keep a soft steady clap and echo their own name in rhythm.

3. The students will be able to pass a beanbag on the beat while listening to Kate's Reel by Bill Birmingham. (Mountain Dulcimer)

4. The students will be able to play a steady beat on the wood blocks.

5. The students will be able to make the beat on the wood blocks move faster and slower to accompany the story The North Wind and the Sun (Music, grade 1, page 112).

6. The students will be able to dramatize the story The North Wind and the Sun.

7. The students will be able to add sound effects with their voices and percussion instruments to help portray The North Wind and the Sun.
Week Six

Monday May 5, 1986 20 minute period

No class today due to a field trip by the entire class.

Week Seven

Monday May 12, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 2/4.

2. The students will be able to keep a soft steady clap and echo their own name in rhythm.

3. The students will be able to find the melodic pattern D-E-F when it occurs in the song I Lost My Glove (Music, grade 1, page 48).

4. The students will be able to play the melodic pattern D-E-F at the appropriate spot in the song I Lost My Glove.

5. The students will be able to sing I Lost My Glove in tune.

6. The students will be able to play the Caribbean game which accompanies the song I Lost My Glove.

7. The students will be able to play the I and V chords necessary to accompany the song I Lost My Glove.
Week Eight

Monday May 19, 1986

20 minute period

Behavioral Objectives:

1. The students will be able to echo clap short phrases based on a meter of 2/4.

2. The students will be able to keep a soft steady clap and echo their own name in rhythm.

3. The students will be able to tap a steady beat while listening to Round and Round the Village (Integrating Music, page 210).

4. The students will be able to sing in tune Round and Round the Village.

5. The students will be able to perform the dance movements which accompany this singing game.

6. The students will be able to tap the drum on the first beat of every measure as an ostinato to accompany the singing game.
Appendix K

Behavioral Objectives

Group II (Special) - Twenty Minute Music Class
Behavioral Objectives:

1. The students will be able to sing in tune the song Sing a Little Song (Music, grade K, page 78).

2. The students will be able to move their arms in an upward direction each time they sing the phrase "Sing a Little Song".

3. The students will be able to play the pitches D-E-F#-G-A in the correct rhythm to accompany the singing of the phrase "Sing a Little Song". The xylophone will be placed in such a manner that the students will be able to see the pitches moving in an upward position as they are being played.

4. The students will be able to locate and identify the melodic pattern (D-E-F#-G-A) when they hear it played in the song.

5. The students will be able to conduct the class in a vocal inflection exercise. They will move their hand up, down, or keep it steady. The class will follow their hand movement with their voices. The pitches need only be relative here.

6. The students will be able to move their bodies while their eyes are closed to show the melodic direction of the example being played by the teacher. The teacher will play short melodic fragments on the piano.
Week Two

Thursday April 10, 1986  20 minute period

Behavioral Objectives:

1. The students will be able to sing Sing a Little Song in tune.

2. The students will be able to move their arms in an upward direction each time they sing the phrase "Sing a Little Song".

3. The students will be able to play a melodic fragment on the xylophone. One fragment will move up, one will move down, and one will stay the same. The rest of the class will move their bodies to demonstrate the movement of the melodic fragments.

4. The students will be able to discuss the melodic movement pictures found on the chart in Music, grade 1, page 143.

5. The students will be able to sing the phrase "the cricket's song" in tune (Music, grade 1, page 144).

6. The students will be able to play the pitches F#-E-D on the xylophone to accompany the phrase "the cricket's song".

7. The students will be able to verbally identify whether or not the two short melodies played by the teacher on the xylophone are the same or different.
Week Three
Thursday April 17, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to mirror the movements created by the teacher.
2. The students will be able to match their movements to the music created in the "Nocturne" from Divertisement by Ibert.
3. The students will be able to create a sound piece using melodic direction arrows and xylophones.
4. The students will be able to play their sound piece creations for the class.
5. The class will be able to draw their classmates sound pieces while they are listening to the selection.

Week Four
Thursday April 24, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to create a sound piece using melodic direction arrows and xylophones.
2. The students will be able to sing the phrases "Fiddle-i-fee", "Chimmy Chuck", and "Quack, Quack" when they occur in the Barnyard Song (The Music Book, grade 2, page 120).
3. The students will be able to arrange the visuals (lines representing the melodic direction of the sung phrases) in the correct order.

4. The students will be able to point to the visual which represents each sung phrase as it happens in the song. (The teacher will mix up the verses here).

Week Five
Thursday May 1, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to sing the Barnyard Song in tune.

2. The students will be able to match the movement of the sung phrases "Fiddle-i-fee, chimmy chuck, and quack, quack" with their hands.

3. The students will be able to play the pitches on the xylophone to accompany the singing of those select phrases.

4. The students will be given the correct pitches and they will have to play the pattern without teacher demonstration. Match the phrase.

5. The students will verbally compare their version of the Barnyard Song and Copland's I Bought Me a Cat.
Week Six

Thursday May 8, 1986

Behavioral Objectives:

1. The students will be able to listen to a short melody played by the teacher on the xylophone and use the visual aids to move up, down or stay the same on the big floor staff.

2. The students will be able to play a short melody on the black keys of the piano moving in only one direction.

3. The students will be able to listen and move to the directional fragments heard in the What Do You Hear (Music, grade 1, record 7).

4. The students will be able to sing in tune Mary Mack (The Music Book, grade 2, page 14).

5. The students will be able to keep the beat while singing Mary Mack.

Week Seven

Thursday May 15, 1986

Behavioral Objectives:

1. The students will be able to sing Mary Mack in tune.

2. The students will be able to point to the melodic contour drawing in rhythm while singing Mary Mack.
3. The students will be able to follow the melodic contour and locate the correct pitches to play "Hi-O" - D and F.

4. The students will be able to play the "Hi-O" pattern as an ostinato while singing Mary Mack.

5. The students will be able to listen to a portion of the second movement of Symphony No. 24 by Mozart and use the contour drawings on page 71 of The Music Book, grade 2 to demonstrate the melodic movement they hear.

Week Eight

Thursday May 22, 1986 20 minute period

Behavioral Objectives:

1. The students will be able to manipulate yarn on a flannel board to represent the melodic fragment played by the teacher.

2. The students will be able to sing The Frog Song in tune (Music, grade 2, page 48).

3. The students will be able to play the glissando to accompany the last word of The Frog Song.

4. The students will be able to play the octave C pitches on the bass xylophone to accompany the The Frog Song.
5. The students will be able to draw the melodic contour of *The Frog Song* on board.

6. The students will be able to move in direction of the melody heard in the second movement of Symphony No. 24 by Mozart.
Appendix L

Software Data Collection Sheet

The Magic Musical Balloon Game
### MAGIC MUSICAL BALLOON GAME DATA SHEET

**NAME:** ____________________  **DATE:** ______________

<table>
<thead>
<tr>
<th>GAME 1</th>
<th>GAME 2</th>
<th>GAME 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2</td>
<td>M</td>
</tr>
</tbody>
</table>

**EX. 1**

| 1 |   |   |   |   |   |   |   |   |
| 2 |   |   |   |   |   |   |   |   |
| 3 |   |   |   |   |   |   |   |   |
| 4 |   |   |   |   |   |   |   |   |

**EX. 2**

| 1 |   |   |   |   |   |   |   |   |
| 2 |   |   |   |   |   |   |   |   |
| 3 |   |   |   |   |   |   |   |   |
| 4 |   |   |   |   |   |   |   |   |

**EX. 3**

| 1 |   |   |   |   |   |   |   |   |
| 2 |   |   |   |   |   |   |   |   |
| 3 |   |   |   |   |   |   |   |   |
| 4 |   |   |   |   |   |   |   |   |

**EX. 4**

| 1 |   |   |   |   |   |   |   |   |
| 2 |   |   |   |   |   |   |   |   |
| 3 |   |   |   |   |   |   |   |   |
| 4 |   |   |   |   |   |   |   |   |

**TOTAL:** ______  **TOTAL:** ______  **TOTAL:** ______
Appendix M

Summary of Data Collected by Individual Student

The Magic Musical Balloon Game

and

Toney Listens to Music
Student Number: 04

<table>
<thead>
<tr>
<th>M</th>
<th>Week 8</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Week 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Week 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Week 5</td>
<td>No graphics</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Week 4</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Week 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Week 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GAME 1       GAME 2       GAME 3
Student Number: 04

TRIALS

0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 2 2 2 2 2 2

TOTA L S

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 L M R S U D T E

LEVEL

1 L L R R L L L L L L L L L M R E ............ 8 1 5 0 0 0 0 1
2 R L L L R L L L R L L R L L R L L R L L R L L R L R L .......... 1 1 0 0 0 0 0 1
3 R L L L L L L L L L L L L L L L L L L L L L L L L L .......... 1 3 0 8 0 0 0 0 1
4 R L L L L L L L L L L L L L L L L L L L L L L L L L .......... 6 0 9 1 0 0 0 1
5 R R S R L L L L L L L L L L L L L L L L L L L L L L .......... 1 4 0 7 1 0 0 0 1
6 L L L L L L L L R L L R L R L L R R R L L L R L L L .......... 1 4 0 1 0 1 0 0 0 0
7 E ................. 0 0 0 0 0 0 0 0 1
8 ................. 0 0 0 0 0 0 0 0 0

I----------CORRECT----------I I----------INCORRECT--------I

LEVEL L# L% R# R% TOTAL TOT% M# M% S# S% TOTAL TOT%
1 8 57 5 38 13 92 1 7 0 0 1 7
2 11 52 10 47 21 100 0 0 0 0 0 0
3 13 61 9 38 21 100 0 0 0 0 0 0
4 6 37 9 56 15 93 0 0 1 6 1 6
5 14 63 7 31 21 95 0 0 1 4 1 4
6 14 55 10 39 24 95 0 0 1 2 1 3
7
8

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX #1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX #2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
* = STUDENT DID NOT REACH THAT TRIAL
<table>
<thead>
<tr>
<th>Week 8</th>
<th>Week 7</th>
<th>Week 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>C</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Week 7**
- Field Trip
- Absent

**Week 6**
- No graphics

**Week 5**

**Week 4**

**Week 3**

**Week 2**

**GAME 1** | **GAME 2** | **GAME 3**
Student Number: 07

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TRIALS 1</th>
<th>TRIALS 2</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LRLLALRLRMLRE...</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>LLLRRRLRRRRLRLRMLSL</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>RRRLLLRLLLRLRLLRLLRRRLLLRLR</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>RRRSSLLRRMLMLMRRRSB...</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>LLLLRRLLLRLRLLRLLLRLR</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>LLLRLMLLLRMLLLMLRLMLR</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>RRRLLRRLRRSLRLLLLLLE...</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>..................</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
Student Number: 11

Week 8
Week 7
   Field Trip
Week 6
Week 5
Week 4
Week 3
Week 2

GAME 1   GAME 2   GAME 3
### STUDENT NUMBER: 11

**TRIALS**

<table>
<thead>
<tr>
<th>Level</th>
<th>L</th>
<th>M</th>
<th>R</th>
<th>S</th>
<th>U</th>
<th>D</th>
<th>T</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L</td>
<td>L</td>
<td>R</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>R</td>
<td>L</td>
</tr>
<tr>
<td>2</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>R</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>3</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>4</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>S</td>
<td>L</td>
</tr>
<tr>
<td>5</td>
<td>R</td>
<td>A</td>
<td>L</td>
<td>L</td>
<td>R</td>
<td>M</td>
<td>R</td>
<td>L</td>
</tr>
<tr>
<td>6</td>
<td>L</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>R</td>
<td>R</td>
<td>L</td>
</tr>
<tr>
<td>7</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>R</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>8</td>
<td>S</td>
<td>R</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>R</td>
</tr>
</tbody>
</table>

**TOTALS**

1. **LEVEL**
   - L: 6
   - M: 1
   - R: 8
   - S: 9
   - U: 2
   - D: 3
   - T: 1
   - E: 7

2. **1**
   - Correct: 6
   - Incorrect: 0

3. **2**
   - Correct: 6
   - Incorrect: 0

4. **3**
   - Correct: 9
   - Incorrect: 0

5. **4**
   - Correct: 8
   - Incorrect: 0

6. **5**
   - Correct: 9
   - Incorrect: 1

7. **6**
   - Correct: 10
   - Incorrect: 0

8. **7**
   - Correct: 11
   - Incorrect: 0

9. **8**
   - Correct: 8
   - Incorrect: 0

---

**Legend:**

- **L**: Correct pick of box #1 (left box)
- **M**: Incorrect pick of box #1
- **R**: Correct pick of box #2 (right box)
- **S**: Incorrect pick of box #2
- **U**: Advancement because of criterion
- **D**: Lowered a level due to criterion
- **T**: Student ran out of time
- **E**: Teacher stopped program
- **.**: Student did not reach that trial
Student Number: 12

Week 8
M: 2
C: __________

Week 7
M: 2
C: __________

Week 6
M: 2
C: __________

Week 5
M: 2
C: __________

Week 4
M: 2
C: __________

Week 3
M: 2
C: __________

Week 2
M: 2
C: __________

GAME 1  GAME 2  GAME 3
Student Number: 12

| TRIALS | 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 | TOTALS | 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 | L | M | R | S | U | D | T | E |
|--------|----------------------------------|--------|-----------------|---|---|---|---|---|---|
| LEVEL  | 1 L R L L R L R M S H M E . . . . . . . . | TOTAL | 5 3 5 1 0 0 0 1 | | | | | |
| 2 R M R S L M L M S L L L A S R L R M L L E | | 8 4 5 3 0 0 0 1 | | | | | |
| 3 R L M L L R L R R L S R R L R M M R E | | 5 3 9 1 0 0 0 1 | | | | | |
| 4 L L L S M S H L M L M M L M L M L E | | 6 5 0 3 0 0 0 1 | | | | | |
| 5 . . . . . . . . . . . . . . . . . . . . . | | 0 0 0 0 0 0 0 0 | | | | | |
| 6 . . . . . . . . . . . . . . . . . . . . . | | 0 0 0 0 0 0 0 0 | | | | | |
| 7 . . . . . . . . . . . . . . . . . . . . . | | 0 0 0 0 0 0 0 0 | | | | | |
| 8 . . . . . . . . . . . . . . . . . . . . . | | 0 0 0 0 0 0 0 0 | | | | | |

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>L#</th>
<th>L%</th>
<th>R#</th>
<th>R%</th>
<th>TOTAL TOT%</th>
<th>M#</th>
<th>M%</th>
<th>B#</th>
<th>B%</th>
<th>TOTAL TOT%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>35</td>
<td>5</td>
<td>35</td>
<td>10</td>
<td>71</td>
<td>3</td>
<td>21</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>39</td>
<td>5</td>
<td>25</td>
<td>13</td>
<td>64</td>
<td>4</td>
<td>19</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>27</td>
<td>9</td>
<td>50</td>
<td>14</td>
<td>77</td>
<td>3</td>
<td>16</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>42</td>
<td>5</td>
<td>35</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>7</td>
<td>39</td>
<td>3</td>
<td>14</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>7</td>
<td>39</td>
<td>3</td>
<td>14</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
<table>
<thead>
<tr>
<th>Week</th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No graphics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Student Number: 14
Student Number: 14

**TRIALS**

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>R</th>
<th>L</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>R</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>R</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>R</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>

**TOTALS**

1234567890123456789012345

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>L#</th>
<th>L%</th>
<th>R#</th>
<th>R%</th>
<th>TOTAL</th>
<th>TOTX</th>
<th>M#</th>
<th>M%</th>
<th>S#</th>
<th>S%</th>
<th>TOTAL</th>
<th>TOTX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>57</td>
<td>6</td>
<td>31</td>
<td>17</td>
<td>89</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>43</td>
<td>12</td>
<td>47</td>
<td>23</td>
<td>91</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>35</td>
<td>15</td>
<td>59</td>
<td>24</td>
<td>95</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>45</td>
<td>11</td>
<td>45</td>
<td>22</td>
<td>91</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>47</td>
<td>11</td>
<td>52</td>
<td>21</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX #1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX #2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
<table>
<thead>
<tr>
<th>Week</th>
<th>GAME 1</th>
<th>GAME 2</th>
<th>GAME 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Student Number: 20

**TRIALS**

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TOTALS</th>
<th>L</th>
<th>M</th>
<th>R</th>
<th>S</th>
<th>U</th>
<th>D</th>
<th>T</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000000011111111112222222</td>
<td>1234567890123456789012345</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

**LEVEL**

1. RRLML L RRLMSE........... 4 2 4 1 0 0 0 1
2. RLRRLRLRLRLLLRRRMMRME..... 8 2 8 0 0 0 0 1
3. L RRLML RARARLALLLARLRRE.. 8 1 1 2 0 0 0 0 1
4. RRLRRMRMLRRLLRLLLE.....10 1 7 0 0 0 0 1
5. LLLLRLRRLRALLLRLLLRE.....11 0 8 0 0 0 0 1
6. MLLRRRLRLRLLLRRMRRPLLRE....6 2 1 1 0 0 0 1
7. ..................................0 0 0 0 0 0 0 0
8. ..................................0 0 0 0 0 0 0 0

I----------CORRECT----------I I----------INCORRECT----------I

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>L</th>
<th>L%</th>
<th>R</th>
<th>R%</th>
<th>M</th>
<th>M%</th>
<th>S</th>
<th>S%</th>
<th>TOTAL TOT%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>18</td>
<td>1</td>
<td>8</td>
<td>32 TOTAL 27</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>21</td>
<td>4</td>
<td>16</td>
<td>2</td>
<td>11</td>
<td>0</td>
<td>2</td>
<td>11 TOTAL 11</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>39</td>
<td>12</td>
<td>57</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4 TOTAL 4</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>57</td>
<td>7</td>
<td>38</td>
<td>2</td>
<td>17</td>
<td>94</td>
<td>14</td>
<td>1 TOTAL 1</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>57</td>
<td>8</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0 TOTAL 0</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>29</td>
<td>11</td>
<td>54</td>
<td>2</td>
<td>9</td>
<td>17</td>
<td>3</td>
<td>14 TOTAL 14</td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = CORRECT PICK OF BOX #2 (RIGHT BOX)
R = INCORRECT PICK OF BOX #1
S = INCORRECT PICK OF BOX #2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
Student Number: 22

GAME 1         GAME 2         GAME 3
Student Number: 22

TRIALS

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 0</td>
</tr>
<tr>
<td>2</td>
<td>0 4</td>
</tr>
<tr>
<td>3</td>
<td>0 0</td>
</tr>
<tr>
<td>4</td>
<td>0 0</td>
</tr>
<tr>
<td>5</td>
<td>0 0</td>
</tr>
<tr>
<td>6</td>
<td>0 0</td>
</tr>
<tr>
<td>7</td>
<td>0 0</td>
</tr>
<tr>
<td>8</td>
<td>0 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I———CORRECT———</th>
<th>I———INCORRECT———</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL</td>
<td>L#</td>
</tr>
<tr>
<td>-------</td>
<td>----</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>31</td>
</tr>
<tr>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>31</td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
Student Number: 25

<table>
<thead>
<tr>
<th>Week 8</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 2 C</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 2 C</td>
</tr>
</tbody>
</table>

GAME 1  GAME 2  GAME 3
Student Number: 25

<table>
<thead>
<tr>
<th>TRAILS</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 2 2 2 2 2 2</td>
<td>1 2 3 4 5 6 7 8 9 0 1 2 3 4 5</td>
</tr>
<tr>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>3</td>
<td>R</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>R</td>
<td>1 5</td>
<td>6</td>
<td>0</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>2 2</td>
<td>1 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1 0</td>
<td>6</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>9</td>
<td>1 5</td>
<td>8 8</td>
<td>2</td>
<td>1 1</td>
</tr>
<tr>
<td>S</td>
<td>4</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2 9</td>
<td></td>
</tr>
</tbody>
</table>

| L | L | L | L | M | L | M | L | L | R | L | R | L | E | ... | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 1 |

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>TOTALS</th>
</tr>
</thead>
</table>

I = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
<table>
<thead>
<tr>
<th>Level</th>
<th>L</th>
<th>M</th>
<th>R</th>
<th>S</th>
<th>U</th>
<th>D</th>
<th>T</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Student Number:** 28

**TRIALS**

| Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level | Level |Level |
Student Number: 29

<table>
<thead>
<tr>
<th>Week 8</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 7</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td>Field Trip</td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td>Absent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td>No graphics</td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M:</td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
</tr>
<tr>
<td>C:</td>
<td></td>
</tr>
</tbody>
</table>

GAME 1  GAME 2  GAME 3
Student Number: 29

TRIALS

0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 2 2 2 2 2 2
1 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5

LEVEL

1  L L R R R R L A L L R R L R R E . . . . . . . 6 0 11 0 0 0 0 1
2  L L L L L L R R L R R R R R R A L L L R R L L R A 10 0 15 0 0 0 0 0
3  R R L L L L R R R R A R L R R L R R L R R L R R L R 11 0 12 2 0 0 0 0
4  L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L
Student Number: 30

TRIALS

0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 2 2 2 2 2
1 2 3 4 5 6 7 8 9 0 1 2 3 4 5

TOTALS

L M R S U D T E
11 0 6 0 0 0 0 1
11 1 1 1 0 0 0 1
7 0 8 0 0 0 0 0
7 0 1 2 0 0 0 1
7 0 1 5 0 0 0 0
1 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0

I---------CORRECT---------I
LEVEL L% L R% R% TOTAL TOT% M% M% S% S% TOTAL TOT%
1 11 64 6 35 17 100 0 0 0 0 0 0
2 11 48 11 43 22 91 1 4 1 4 2 8
3 7 46 8 53 15 100 0 0 0 0 0 0
4 7 33 12 57 19 90 0 0 2 9 2 9
5 8 31 15 59 25 91 0 0 2 7 2 7
6 1 100 0 0 1 100 0 0 0 0 0 0
7
8

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
<table>
<thead>
<tr>
<th>Week 8</th>
<th>Week 7</th>
<th>Week 6</th>
<th>Week 5</th>
<th>Week 4</th>
<th>Week 3</th>
<th>Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No graphics</td>
<td>Field Trip</td>
<td>Absent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GAME 1    GAME 2    GAME 3
**Student Number: 34**

**TRIALS**

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>L</th>
<th>M</th>
<th>R</th>
<th>S</th>
<th>U</th>
<th>T</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>2</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>3</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>4</td>
<td>R</td>
<td>M</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>L</td>
</tr>
<tr>
<td>5</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>6</td>
<td>L</td>
<td>R</td>
<td>M</td>
<td>M</td>
<td>S</td>
<td>M</td>
<td>S</td>
</tr>
<tr>
<td>7</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>L</td>
<td>R</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

**TOTALS**

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
<td>39</td>
<td>11</td>
<td>20</td>
<td>10</td>
<td>86</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>47</td>
<td>13</td>
<td>51</td>
<td>25</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>21</td>
<td>9</td>
<td>47</td>
<td>13</td>
<td>68</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>55</td>
<td>7</td>
<td>27</td>
<td>21</td>
<td>83</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>23</td>
<td>10</td>
<td>39</td>
<td>16</td>
<td>63</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>42</td>
<td>3</td>
<td>42</td>
<td>6</td>
<td>85</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**I-------CORRECT-------I I-------INCORRECT-------I**

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>L%</th>
<th>L%</th>
<th>R%</th>
<th>R%</th>
<th>TOTAL</th>
<th>M%</th>
<th>M%</th>
<th>S%</th>
<th>S%</th>
<th>TOTAL</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>1</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>39</td>
<td>11</td>
<td>20</td>
<td>86</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>47</td>
<td>13</td>
<td>51</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>21</td>
<td>9</td>
<td>47</td>
<td>68</td>
<td>4</td>
<td>21</td>
<td>10</td>
<td>6</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>55</td>
<td>7</td>
<td>27</td>
<td>83</td>
<td>2</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>23</td>
<td>10</td>
<td>39</td>
<td>63</td>
<td>5</td>
<td>19</td>
<td>9</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>42</td>
<td>3</td>
<td>42</td>
<td>85</td>
<td>1</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX #1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX #2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
<table>
<thead>
<tr>
<th>Week</th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: No graphics for Week 5.
Student Number: 38

GAME 1
GAME 2
GAME 3
Student Number: 38

TRIALS

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>LMRSUDET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LRRRRLRRRAABRLMLE...</td>
</tr>
<tr>
<td>2</td>
<td>LRRRLRRLLRRLLLLLLLE...</td>
</tr>
<tr>
<td>3</td>
<td>LMRRLRRRRRRRLRLLRLLLLE...</td>
</tr>
<tr>
<td>4</td>
<td>RLLRLRRLLRRRRRLLRRRRE...</td>
</tr>
<tr>
<td>5</td>
<td>RMRRLRLRRMRLLRLMRRLLRE...</td>
</tr>
<tr>
<td>6</td>
<td>RMLRLRLRRLRLRARRRALA...</td>
</tr>
<tr>
<td>7</td>
<td>RRRRLLLRRRLRRRLLLRE...</td>
</tr>
<tr>
<td>8</td>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>LMRSUDET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 0 0 0 1</td>
</tr>
<tr>
<td>2</td>
<td>1 0 0 0 1</td>
</tr>
<tr>
<td>3</td>
<td>1 0 0 0 1</td>
</tr>
<tr>
<td>4</td>
<td>0 1 2 0 0 1</td>
</tr>
<tr>
<td>5</td>
<td>1 0 0 0 1</td>
</tr>
<tr>
<td>6</td>
<td>9 1 2 1 0 0 1</td>
</tr>
<tr>
<td>7</td>
<td>8 0 9 0 0 0 1</td>
</tr>
<tr>
<td>8</td>
<td>0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

I——CORRECT——I  I——INCORRECT——I

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>LMRSUDET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
* = STUDENT DID NOT REACH THAT TRIAL
Student Number: 39

Week 8

Week 7

Week 6

Week 5
No graphics

Week 4

Week 3

Week 2

GAME 1  GAME 2  GAME 3
### Trials

<table>
<thead>
<tr>
<th>Level</th>
<th>R</th>
<th>L</th>
<th>M</th>
<th>S</th>
<th>U</th>
<th>D</th>
<th>E</th>
<th>T</th>
<th>N</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 1 7 0 0 0 0 1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 1 3 0 0 0 0 0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 0 1 3 1 0 0 0 0</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 3 0 0 0 0 1 1</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 0 7 1 0 0 0 1</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 1 9 1 0 0 0 1</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9 2 7 1 0 0 0 1</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

---

**Legend:**
- **L** = Correct Pick of Box #1 (Left Box)
- **M** = Incorrect Pick of Box #1
- **R** = Correct Pick of Box #2 (Right Box)
- **S** = Incorrect Pick of Box #2
- **U** = Advancement Because of Criterion
- **D** = Lowered a Level Due to Criterion
- **T** = Student Ran Out of Time
- **E** = Teacher Stopped Program
- **.** = Student Did Not Reach That Trial
### Student Number: 41

#### TRIALS

<table>
<thead>
<tr>
<th>0000000000111111111111222222</th>
<th>TOTALS 1234567890123456789012345</th>
<th>LMRSUDTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL</td>
<td>1</td>
<td>LSBSRLLRRRLARRARRE</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>LRRARRRLLLRLRLLMLRRRL</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>LRRLLMLLLRLRRSLRMLRRLLLR</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>RLMMSRLLRLMLARRRRE</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>LRRLLRRARARASLLLALLARRR</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>LMRSLRLLLMMRRLLRRMLRRLE</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>LRRRLRSLRLRLLLRLRRR</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I--------CORRECT---------I</th>
<th>I--------INCORRECT--------I</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL</td>
<td>L#</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

- L = Correct Pick of Box #1 (Left Box)
- M = Incorrect Pick of Box #1
- R = Correct Pick of Box #2 (Right Box)
- S = Incorrect Pick of Box #2
- U = Advancement Because of Criterion
- D = Lowered a Level Due to Criterion
- T = Student Ran Out of Time
- E = Teacher Stopped Program
- . = Student Did Not Reach That Trial
Student Number: 48

<table>
<thead>
<tr>
<th></th>
<th>GAME 1</th>
<th>GAME 2</th>
<th>GAME 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No graphics
Student Number: 48

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>R L L L L L M R L R R R L E</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>R L L R M L L L R R R R R L L R L L R L L L L L L L R</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R L L L R L L L R R R R R R L R L L L R L L R R</td>
<td>12</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L L R R L L R R L L L L L L L L R R</td>
<td>10</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L L L L R L R R L L L L R R L L L L L R</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L L R R R L R R L L L L R R R L L L L L R</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L L R R R L R R L R R L L R L R L</td>
<td>9</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L L R R R L R R L R R L L L L L</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I———CORRECT———I I———INCORRECT———I

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>L%</th>
<th>L%</th>
<th>R%</th>
<th>R%</th>
<th>TOTAL</th>
<th>TOTX</th>
<th>M%</th>
<th>M%</th>
<th>S%</th>
<th>S%</th>
<th>TOTAL</th>
<th>TOTX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>33</td>
<td>5</td>
<td>38</td>
<td>12</td>
<td>92</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>50</td>
<td>11</td>
<td>45</td>
<td>22</td>
<td>95</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>57</td>
<td>9</td>
<td>42</td>
<td>21</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>52</td>
<td>8</td>
<td>42</td>
<td>18</td>
<td>94</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>50</td>
<td>11</td>
<td>45</td>
<td>23</td>
<td>93</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>33</td>
<td>14</td>
<td>43</td>
<td>25</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>30</td>
<td>9</td>
<td>50</td>
<td>18</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

L = CORRECT PICK OF BOX #1 (LEFT BOX)
M = INCORRECT PICK OF BOX 1
R = CORRECT PICK OF BOX #2 (RIGHT BOX)
S = INCORRECT PICK OF BOX 2
U = ADVANCEMENT BECAUSE OF CRITERION
D = LOWERED A LEVEL DUE TO CRITERION
T = STUDENT RAN OUT OF TIME
E = TEACHER STOPPED PROGRAM
. = STUDENT DID NOT REACH THAT TRIAL
LIST OF REFERENCES


