

To the Graduate Council:

I am submitting herewith a thesis written by Gerald Woodyard Chastain, Jr. entitled "A Study to Develop and Implement a Computer-Based Melodic Interval Course and to Compare That Course With an Established Drill Method." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Music.

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A STUDY TO DEVELOP AND IMPLEMENT A COMPUTER-BASED MELODIC
INTERVAL COURSE AND TO COMPARE THAT COURSE
WITH AN ESTABLISHED DRILL METHOD

A Thesis
Presented for the
Master of Music
Degree
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Gerald Woodyard Chastain, Jr.

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DEDICATION

This study is dedicated with love to my son, Barney Harold Chastain.

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ABSTRACT

Aural identification and notation of melodic intervals are basic skills in college-level aural training. Repetitive drill is considered an essential discipline in obtaining these skills, but present drill methods suffer from numerous disadvantages. Although computer-based instruction has offered a remedy for these disadvantages, the cost of large computing systems has been prohibitive for most educational institutions. Microcomputers have been developed in the last few years which have made computer-based aural training a general economic possibility, but there is a lack of comprehensive music courseware for these machines. The purpose of this study has been to develop and implement such courseware, using an Apple II microcomputer, and to compare that courseware to an existing drill method which has been used at The University of Tennessee, Knoxville, for seven years. This method utilizes tape recordings in conjunction with a printed workbook.

A nine-week experiment was conducted during the Fall Quarter, 1979. The subjects in the experiment were thirty-six freshman ear-training students at The University of Tennessee, Knoxville. All students attended two regular classes per week and were taught by the same instructor. A control group, consisting of seventeen students, accomplished drill work outside of class using the tape recording/workbook method; while an experimental group used the computer-based course.

A pre-test and a post-test provided data which were used to make a statistical comparison of the two methods. The comparison of the pre-test scores indicated that the two groups were homogeneous. The comparison of the post-test scores indicated that the experimental group attained a higher level of achievement than the control group. The total raw score improvement of the experimental group was 112 percent, while that of the control group was only 74 percent.

The Apple II microcomputer was found to be well suited for melodic interval instruction. Furthermore, automatic record-keeping was easily implemented in conjunction with that instruction. The primary conclusion of the study was that the computer-based course was clearly superior to the tape recording/workbook method.

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INTRODUCTION

Melodic intervals constitute the ABC's of aural training. The linked skills of aural identification and notation of melodic intervals are the basic building blocks upon which are founded the more advanced skills of melodic and harmonic dictation. Difficulty encountered in acquiring these latter skills can frequently be attributed to an inability to do the former. For many students, the acquisition of these skills presents no obstacle; for others, aural training can become a highly frustrating stumbling block. This study was concerned primarily with alleviating the problems encountered by these students.

Definitions of Terms

CBI. Computer-Based Instruction is a standard term referring to the use of the computer as a teaching machine. CBI is synonymous with CAI (Computer-Assisted Instruction) and CBE (Computer-Based Education).

Tape recording/workbook method. This method for teaching ear training uses recorded exercises in conjunction with a printed workbook. The specific materials used for comparison in this study were Programmed Ear Training, Volume I: Intervals, with accompanying tape recordings, by Leo Horacek and Gerald Lefkoff and published by Harcourt, Brace & World, Inc., New York, 1970.

Melodic Interval Course. This title is given to the CBI course developed by me for this study.

Interactive. This term refers to computer programs in which there is immediate communication between the user and the computer. This communication is accomplished by means of output devices, such as cathode ray tubes (CRT), and input devices, such as typewriter keysets.

CRT. The picture tube of a standard television set is a cathode ray tube. When used as an output device for a computer, the CRT may display text, color graphics, or a combination of the two. The CRT used in this study was a thirteen-inch Sony Trinitron color television.

Redefined keyboard. A common input device for computers is a standard typewriter keyset. The input device used in this study was such a keyset which was redefined by placing stickers on the fronts of certain keys. For a diagram of this keyset, see Figure 1 on the following page.

Digital synthesizer. This sound synthesizing device can be connected to and controlled by the computer. The synthesizer used in this study was the ALF Sound Board, produced by ALF Industries, Denver, Colorado.

Computer management. In computer-based instruction, this term refers to the application of the computer to course related administrative tasks, such as record-keeping and scheduling of computer time.

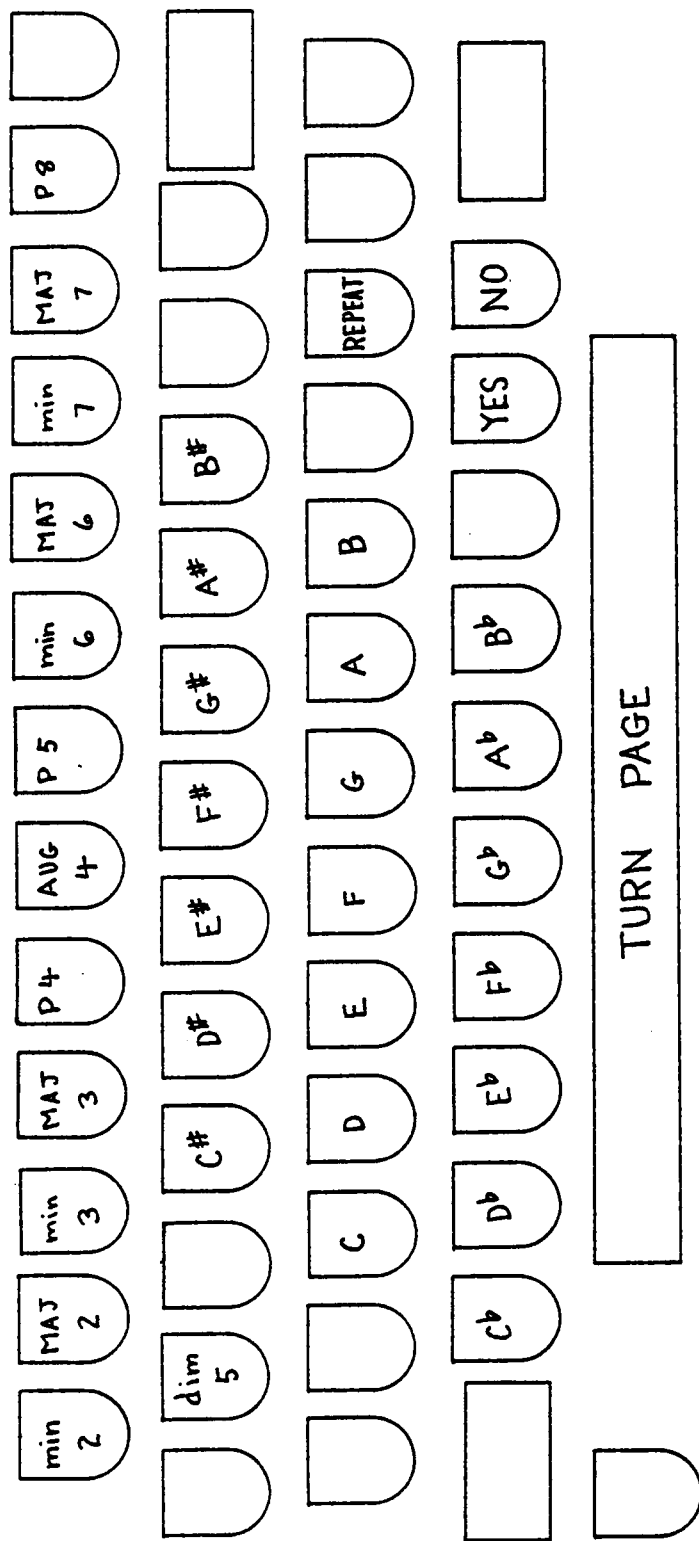


Figure 1. Redefined Keyboard

Control group. The control group consisted of seventeen freshman music students at The University of Tennessee, Knoxville, who used the tape recording/workbook method.

Experimental group. The experimental group consisted of nineteen freshman music students at The University of Tennessee, Knoxville, who used the Melodic Interval Course.

Microcomputer. Also referred to as personal computers, these small machines utilize approximately eight to forty-eight kilobytes of random access memory. The Apple II micro-computer was the computer used in this study.

Exercise. This term, as used in this paper and in the Melodic Interval Course, refers to a computer generated set of melodic intervals which may be used either for test or for drill purposes.

Course position. The course position is a number, stored in the computer, ranging from zero to thirty-six, which indicates a student's level of progress in the Melodic Interval Course.

Floppy disk. A magnetic disk used for information storage.

Page. As used in this paper, the word "page" refers to one CRT screen of information, whether as text, graphics, or a combination.

Gaps in the Instructional Process

Various aids may be used to facilitate aural training; each possessing advantages and disadvantages. It is generally accepted

that, regardless of the method used, repetitive drill is essential. The following brief descriptions of available drill methods reveal the problems that exist in this area of music education.

Drill work in a class situation cannot allow for individual differences in students. However, a distinct advantage of classroom work is the opportunity afforded the student to gain an understanding of theoretical concepts which may assist him in acquiring the desired aural skills.

A one-to-one student-teacher ratio allows individualized training. Each error can be corrected, weak areas identified, special remedial work provided, etc. The disadvantage of this method is the prohibitive cost.

Self-monitored drill, typically done at the piano keyboard, can be impractical for a number of reasons. The student may lack the necessary keyboard and/or music reading skills. He may also lack the necessary self-discipline.

Co-operative drill, in which one student plays an interval which the other then identifies, can provide an effective learning situation. The student can receive immediate feedback on each example, and the work can be individualized. However, the students may lack the understanding to help each other in problem areas.

Drill methods which use a combination of recorded exercises and printed workbooks are available and in use today. No keyboard knowledge is required, and the student need not fear exhausting the patience of a teacher or friend. The disadvantages of this method center around the limitations of printed and recorded materials.

Because of cost, a limited number of exercises can be made available. Often, a student who has a problem with a particular interval can only repeat the same exercise; he may actually memorize the exercise before he achieves the degree of proficiency desired. Another disadvantage is the need to manipulate shields which cover the answers.

The advantages offered by computer-based instruction place it in contrast with all other methods. These advantages are discussed in Chapters I and II. Computer-based instruction offers a remedy for the problems associated with other drill methods, and makes possible a learning environment previously unavailable.

The Need for Microcomputer-Based Music Courses

A considerable library of excellent aural training courseware has been developed for certain mainframe computers, most notable of which is the PLATO system now in use at several large universities. Aural training available on PLATO ranges from the basics of melodic intervals through four voice harmonic dictation. This system offers all the advantages of computer-based music instruction. Student progress is automatically recorded, and the computer can diagnose weak areas. A digital synthesizer generates sound, and music notation is displayed on a CRT. The CRT is touch sensitive so that the student can indicate his response by simply touching the appropriate spot. PLATO is an excellent teaching machine, both in terms of hardware and courseware. However, it suffers a major disadvantage: a cost which is generally considered to be prohibitive.

Cost analysis of computer-based instruction is not within the scope of this study; however, the following comparison will provide a rough approximation of costs. A complete Apple II microcomputer system, such as the one used in this study, costs three thousand dollars. If this system were used only forty hours per week for only one academic year, the total use would be twelve hundred hours with a resulting cost of \$2.50 per hour of instruction. The salary of a faculty member teaching forty hours per week at twelve thousand dollars per academic year would result in a cost of \$10.00 per instructional hour. This is a conservative comparison for two reasons. First, the Apple II is a reliable machine and will provide considerably more than one academic year of service with little or no additional cost. Second, a CBI course utilizing the Apple II provides individualized drill with maximum feedback, whereas it is simply unfeasible that a teacher devote forty hours a week to individualized instruction.

Summary of the Study

In summary, three problems exist. The first is that current methods of aural training suffer numerous disadvantages. Computer-based instruction offers a remedy for those disadvantages. Secondly, although excellent aural training courseware is available on some main-frame computer systems, their prohibitive cost makes them impractical for general use. The third problem is the lack of comprehensive music courseware which takes full advantage of the microcomputer for this application. The purpose of this study has been to develop a practical comprehensive CBI course for training college students in

identification and notation of simple melodic intervals, and to compare the effectiveness of the CBI course with a tape recording/workbook drill method.

Only the CBI course and the tape recording/workbook method were compared. The study did not measure student reaction or attitude toward either method. The population in the study was non-average in that the investigator intentionally selected students scoring less than 50 percent on the pre-test. Skill objectives in the study were limited to identification and notation of simple melodic intervals. The amount of study time of the two groups, experimental and control, was not measured. Both groups had the same classroom instructor, and class attendance was mandatory.

Two hypotheses were tested in this experiment. The first hypothesis was that there would be no significant difference in variance between the scores of the control group and the scores of the experimental group on the pre-test. The second hypothesis was that the achievement of the experimental group, as measured by the post-test, would not be significantly greater than the achievement of the control group as measured by the same test.

CHAPTER I

A HISTORY OF COMPUTER-BASED MUSIC INSTRUCTION

Although the history of computer applications in music education begins in 1967, development of computer-based aural training programs has been delayed by a technical problem:

Review of the literature pertaining to research in computer-based music instruction has shown that there has been limited use of audio in CAI music lessons. Problems encountered by all researchers suggest that research and development of effective audio hardware is needed with rapid random access and high fidelity of sound as prerequisites. To date, sound sources have limited the scope and flow of instructional materials....¹

A significant hindrance to widespread development of CBI has been the expense of large computing systems. In June, 1980, the Art, Music and Humanities Taskgroup distributed a progress report consisting of a bibliography and narrative. This report was the result of a March, 1980, mailing of 112 survey forms requesting information about computer applications in education. The present potential for CBI development and implementation is stated in the report:²

There has been rapid growth in the availability of small personal computers and in peripheral devices useful in art and music instruction which can attach to the small computers. These factors combined with the dropping cost of these items

¹Nan Watanabe, "Review of Audio Interfacing Literature for Computer-Assisted Music Instruction," Journal of Computer-Based Instruction, Vol. 6, No. 3 (1980), p. 89.

²Beverly J. Jones, Progress Report #3 of the Art, Music, and Humanities Taskgroup, Association for Computing Machinery--Elementary and Secondary Schools Subcommittee, Eugene, Oregon (1980), p. 6.

make it economically feasible to consider the use of instructional computing in art, music, and humanities classrooms within the public school system.

As a consequence of the problems encountered with earlier audio devices and the recent availability of small personal computers, most of the work done in the field of computer-based aural training has occurred within the last few years. This review divides the literature concerning computer-based music education into two periods: 1967 to 1977--pioneering efforts; and 1977 to the present--development and implementation. This chapter closes with a brief discussion concerning the Association for the Development of Computer-Based Instructional Systems.

Pioneering Efforts--1967 to 1977

The earliest computer-based music instruction project was conducted at Stanford University, an ambitious endeavor in that the hardware involved was capable not only of sound generation, but also of input and evaluation of sung pitches.

The tentative and experimental nature of this initial research must be emphasized. Its principal objective was to study the interaction between student and machine. Given the complexity of the device, there was some initial doubt that it would work at all.³

Although student reaction was favorable and the researchers developed a method of presentation of feedback which was later used by Deihl, the state of computer technology at the time did not allow practical implementation.

³Wolfgang E. Kuhn and Raynold L. Allvin, "Computer-Assisted Teaching: A New Approach to Research in Music," Journal of Research in Music Education, Vol. 15, No. 4 (1967), p. 309-310.

Hullfish conducted a comparative study at State University College in Brockport, New York, in 1969. The programming language used was Coursewriter, and no aural training was involved.

The study was intended to determine whether students using a program whose branching was based on a history of responses would differ significantly in learning from students using a program whose branching was based on the last response.⁴

The conclusion reached was that response-sensitive programming does indeed result in greater achievement than response-insensitive programming.

An eight week pilot program was conducted at Pennsylvannia State University in 1971. The computing hardware was an IBM instructional system consisting of a rear illuminated image projector for displaying notation, a CRT for instructions and question and answer format, an audio play/record unit, a light pen, and a typewriter keyset. The program was designed to teach phrasing, articulation, and rhythm to intermediate clarinetists at the secondary school level. The bulk of the aural training was centered around aural-visual discrimination. In such items, the student was presented musical examples containing one or more aural discrepancies. As with other work during this period, implementation was seen to be impractical: "Present costs would seem to limit CAI to curricula involving the most basic and applicable principles with related off-line drill programs."⁵

⁴William R. Hullfish, "A Comparison of Two CAI Programs in Music Theory," Journal of Research in Music Education, Vol. 20, No. 3 (1972), p. 354.

⁵Ned C. Diehl, "Computer-Assisted Instruction and Instrumental Instruction: Implications for Teaching and Research," Journal of Research in Music Education, Vol. 19, No. 3 (1971), p. 306.

In 1973, Hultberg reported that computer-assisted instructional programs had been under development at the State University, Potsdam, New York, since 1967. The computer used was the IBM 1401, although since 1969 an IBM 360/30 had been used. The principal language was Coursewriter, with some work being done in BASIC and consideration being given to APL. CAI programs in use included units in common practice theory and Greek music theory. The addition of sound capability was planned for the near future.⁶

The PLATO III system was used in a trial implementation at the University of Illinois. The system included a typewriter keyset, a CRT, a random-access slide selector, and a random-access audio device designed for the PLATO IV system. The purpose of the trial was to develop a CAI lesson for teaching rhythm perception to music education students and to determine the effectiveness of the lesson. Students were interviewed at the end of the two-week period and transcriptions of the interviews were analyzed.

Students participating in the trial considered the lesson instructive and enjoyable as an overall experience. They valued the feedback given in a relatively confidential situation and PLATO's ability to define a task, demand input from the student, and quickly judge the input.⁷

Student frustrations were mostly related to computer-student dialogue problems, such as confusing directions and inadequate responses to

⁶Earle W. Hultberg and Mary Lou Hultberg, "CAI in Music Theory: Paradigms: Potential: Problems," Paper presented at the Conference on Computers in the Undergraduate Curricula (Claremont, CA, June 18-20, 1973).

⁷Robert W. Placek, "Design and Trial of a Computer-Assisted Lesson in Rhythm," Journal of Research in Music Education, Vol. 22, No. 1 (1974), pp. 20-21.

student input. A major complaint concerned the audio output device which suffered from a ". . . slight but audible bump or break after 9.6 seconds. . . ."8

Three applications of the computer in the education of music teachers were pilot tested during the 1974-1975 school year at the Eastman School of Music. The first was a mini-course in computer-assisted instruction. The second was a computer game called TEACH. "The game is won by the player who is able to teach the most material most efficiently in the least amount of time."9 The last application was a computer-administered examination.

A CAI program using the PDP-10, along with a Teletype(R) model 33 KSR terminal and a Thomas solid-state organ model 145 attempted to identify problem areas in the pedagogy of melodic and harmonic intervals. The purpose was to measure student accuracy of simple interval identification and to derive ". . . possible yardsticks for measuring progress." This study questioned the

. . . body of informal hypotheses on relative difficulty of interval recognition [which] has developed over the years, e.g., that descending intervals are more difficult than ascending intervals or that dissonances are more difficult than consonances.10

⁸Ibid., p. 19.

⁹Thomas Nelson Saul, "Three Applications of the Computer in the Education of Music Teachers," (Doctoral dissertation, Eastman School of Music, 1976) Dissertation Abstracts International, 1976, 37,1867-A.

¹⁰Rosemary N. Killam, Paul V. Lorton, Jr., and Earl D. Schubert, "Interval Recognition: Identification of Harmonic and Melodic Intervals, Journal of Music Theory, Vol. 19.2 (Fall 1975), p. 214.

A significant finding was that the greatest incorrect response per interval tends to be a semi-tone from the correct interval, and that, of these mistakes, the greatest number tend to cluster at the interval width of the same number name. For this reason, the researchers speculated that ". . . factors other than simple judgement of interval width would seem to be in evidence."¹¹

Development and Implementation--1977 to the Present

A study conducted by Peters verified the effectiveness of CBI for teaching percussion methods, not only in terms of a significant improvement in test scores, but also in terms of time:

. . .the CAI program saved 25 percent of the in-class hours normally used in the presentation of this material, and student study time was shorter using PLATO than before the programs were available.¹²

In referring to CAI availability, Peters mentioned two approaches. The first was to use one large computer to serve hundreds of students, the second was to use mini-computers which serve from one to thirty students.

The smaller computer approach has been used successfully in elementary and high schools and does not require expensive telephone connections to one central computer. Several school districts in northern Illinois are experimenting with the mini-computer approach to CAI.¹³

Because of its ability to store large quantities of data, the computer is an ideal analytical tool for research concerned with

¹¹Ibid., p. 226.

¹²David G. Peters, "Percussion Methods by Computer," Instrumentalist, Vol. 32, No. 6 (1978), p. 43.

¹³Ibid., p. 43.

learning problems. Such work done at the University of Iowa indicated that general patterns existed in the types of errors students made while learning interval identification. The concept underlying that study was that certain intervals would often be confused with certain other intervals. Three thirty-six item tests were given to ninety-one first-year students and to sixty-five second-year students. The reported results of analysis of the data generated from these tests was striking: ". . . 34 interval confusions accumulated enough errors to designate them as significant. In fact these accounted for 81 percent of the errors made . . ." ¹⁴ Also of interest was the conclusion drawn by the researcher that ". . . the most prominent confusion was the major 7th heard as a tritone." ¹⁵ It would seem from those results that the concept of interval confusion merits continued attention by researchers.

As a continuation of an earlier report Hultberg again discussed the development of CAI programs in music theory at the State University of New York at Potsdam. CAI music programs at SUNY have always utilized on campus equipment (IBM systems 360/30 and 360/40) and have been based on standard software modified locally. A current development discussed was "the interfacing of an electronic organ with the computer . . . and the hardware and software modifications found

¹⁴Marvin S. Thostenson, "A Project in Aural Interval Identification, Phase One," Abstract of a paper given at the 1978 Annual ADCIS Conference, Journal of Computer-Based Instruction, Vol. 4, No. 3 (1978), p. 72.

¹⁵Ibid., p. 72.

necessary in order to implement the total project on a dedicated mini-computer configuration."¹⁶

As mentioned in the introduction of this chapter, two factors have delayed general use of CBI in music: problems with sound generation devices and the high cost of large computer systems. Schools which have developed computerized music instruction have used large to mid-size computers. Aside from cost, these computers suffer from various disadvantages. For instance, if a large computer malfunctions (a frequent occurrence), all terminals connected to it may become inactive. Another problem is that the time sharing systems utilized by large computers cause unpredictable hesitations in the sequence of an interactive instructional program. Nevertheless, of necessity the bulk of CAI applications in music have been conducted on such computers. It is important to know if the substantial work done to date can be adapted to smaller, stand-alone microcomputers. The operation of four experimental pilot programs at the University of Illinois demonstrated successful translations of PLATO programs written on a large computer mainframe to a microprocessor. Furthermore, ". . . a stand-alone micro-processor unit has been shown to support high-quality CAI in music, including ear training."¹⁷ As a result of this success, it was

¹⁶Warren E. Hultberg, "Project CLEF: An Update (CAI in Music Theory: Paradigms: Potential: Problems," Abstract of a paper given at the 1979 Annual ADCIS Conference, Journal of Computer-Based Instruction, Vol. 6, No. 1 (1979), p. 38.

¹⁷David G. Peters, "Courseware Development for Micro Computer Based Education in Music," Abstract of a paper given at the 1979 Annual ADCIS Conference, Journal of Computer Based Instruction, Vol. 6, No. 1 (1979), p. 38.

speculated that ". . . this will allow a much larger population of students to come in contract with CBE in music in the future."¹⁸

Considerable development has occurred at the University of Delaware. A computer-based ear-training program called GUIDO included units that taught aural identification of intervals, melodies, chord qualities, harmonies, and rhythms. During the academic year 1977-1978, a controlled experiment was conducted to compare sequential course structure, the programming method which had been used in writing aural interval identification courses, with a new competency-based format. In the original sequential design, a student was required to go through all of the questions in a course in the same order. The new competency-based format would have provisions for the student to be branched ahead according to performance. The results were positive. The competency-based group learned significantly more than did the other group. Also, ". . . the competency-based format caused the student[s]. . . to spend a greater proportion of their time on the more difficult materials. . . ." ¹⁹ It is apparent from that study and from the previously mentioned study by Hofstetter that research concerning application of computers to interval training had reached the point where definitive guidelines were beginning to be formed.

At Indiana University, three PLATO programs are in use: (1) a CBI program designed to provide students with a comprehensive set of

¹⁸Ibid., p. 38.

¹⁹Fred T. Hofstetter, "Controlled Evaluation of a Competency-Based Approach to Teaching: Aural Interval Identification," Abstract of a paper given at the 1979 Annual ADCIS Conference, Journal of Computer Based Instruction, Vol. 6, No. 1 (1979), p. 39.

terms; (2) a program to teach voice leading in triadic tonal music; and (3) a program involving interactive reductive analysis. At Indiana University, there is also interest concerning the use of smaller computers.

The projects that are now being implemented on PLATO are also being planned for implementation on a microcomputer system when one or more dedicated systems for music research and instructional development can be acquired.²⁰

With the knowledge created through experimentation and trial implementation, researchers and institutions now have a store of information upon which to base some general principles. The CBI ear training program at North Texas State University follows a pedagogical philosophy that aural concepts are most effectively presented in the classroom; while student competence and mastery are developed through individualized CAI. Other valuable lessons of CAI experience at NTSU are that:

Curriculum (lessonware) must be based on a comprehensive learning sequence. The first curriculum implemented should be the first semester of ear training.²¹

All curriculum should be written in one style, competence-based, and user tested as it is developed.²²

A trained monitor should be available throughout the [student's] first session.²³

²⁰Gary E. Wittlich, "Developments in Computer Based Music Instruction and Research at Indiana University," Journal of Computer-Based Instruction, Vol. 6, No. 3 (1980), p. 62.

²¹Robert W. Ottman, et al., "Development of a Concept-Centered Ear Training System," Journal of Computer-Based Instruction, Vol. 6, No. 3 (1980), p. 85.

²²Ibid., p. 85

²³Ibid., p. 83.

All curriculum materials should be randomly generated and competence-based. Individualization of learning can best be achieved where the student works on a goal until and only until mastery is reached. The criterion for mastery should be a high percentage of correct answers based on a small number of questions. We²⁴ suggest 9 right of 10 presented on single element answers.

Also important is the question of timing with regard to instrument control. When a time share user momentarily loses priority, no break or distortion in the timing of the musical performance should occur. The NTSU system is one in which the instrument translates and stores a complete score for later performance. Another option would be to place the entire process²⁵ under the dedicated control of a micro or mini-computer.

Advantages of the microprocessor include low cost, flexibility, control in the use of resources, reliability, and superior graphics capabilities (such as the Apple II computer). If one microcomputer is down, only one terminal is affected, and everyone else continues uninterrupted. Micro-computers²⁶ have some disadvantages, such as slow file access time.

A project entitled "Integrated Cybernetic Music System" is currently being developed at Florida State University.

The design of the ICMS will take advantage of the work already done in the synthesis of musical sound, automated music printing, etc. It will be an altogether new thing, however, because it will be a combination of music devices and computer programs linked together via shared music data bases and controlling programs. Such an integrated system²⁷ for music and musicians does not now exist.

²⁴Ibid., p. 82.

²⁵Ibid., p. 80.

²⁶Ibid., p. 80.

²⁷Integrated Cybernetic Music System, Project Description, Center for Music Research, School of Music, Florida State University (March 24, 1980), p. 1.

The ICMS is also intended to serve as the basis for computerized instruction in the art and science of music.²⁸ The basic design of ICMS Music Station for instruction in musicianship includes a CRT terminal with typewriter keyset, a sound synthesizer, headphones, a microphone with pitch extractor, and a music keyboard. ICMS is apparently an extensive project, and a great expenditure in software development is planned. The implications for CBI could be very beneficial:

The first steps in computer-based music education have already been taken; computerized music lessons and ear-training drills have been shown to greatly increase the speed of skill acquisition in certain areas. The ICMS will make it possible to computerize not only ear-training and dictation, but also sight-singing, rudimentary keyboard instruction . . . , and instruction in different styles of composition. One CMR researcher is working on a software system intended to teach young composers the rudiments of 16th century counterpoint, by helping them to write new compositions in that style, and by providing automatic performances of what they have written.²⁹

At least one researcher in music CBI recommends adoption of a minimal student work station which will cost no more than several hundred dollars. The argument for such a station is that all of the personal computers ". . . include features such as standard keyboard, CRT display, diskette, etc., which are useful for programming but which are not indispensable for the pedagogical activity itself."³⁰ The type of station recommended would include only the minimum input and output devices, and memory space needed to run an instructional program.

²⁸Ibid., p. 1.

²⁹Ibid., pp. 11-13.

³⁰Martin Prevel, "Low-Cost Computer-Assisted Ear Training," Journal of Computer-Based Instruction, Vol. 6, No. 3 (1980), p. 77.

Course development would be accomplished on a larger machine capable of such activity.

Computer-based music instruction is no longer in a pioneering stage. Within the last few years developments in technology have made general implementation of CBI a realistic possibility.

What is becoming increasingly more important is not altogether the technological advances, but rather individuals with the motivation, dedication, and administrative knowledge to establish computer-based music programs in more and more institutions.³¹

Larger questions concerning the integration of CAI into existing music programs are now being addressed:

Good relations between the CBE director and the faculty are vital to the success of the program, particularly where the faculty members are otherwise uninvolved in music CAI. Just as many music students are skittish about computers, some music faculty members have similar feelings. Also, faculty may feel left out of the educational process or even replaceable. It is wise to demonstrate courseware to instructors prior to student use, and to continue soliciting faculty input during the actual implementation.³²

I wish to conclude this chapter with mention of two organizations, the Association for the Development of Computer-Based Instructional Systems (ADCIS) and the National Consortium for Computer-Based Music Instruction (NCCBMI). ADCIS has been in existence since 1967 and currently has nearly nine hundred members; approximately 25 percent are Institutional or Sustaining members. The organization publishes a

³¹Dorothy Gross and Roger Foltz, "integration of CAI Into a Music Program," Journal of Computer-Based Instruction, Vol. 6, No. 3 (1980), p. 75.

³²Ibid., p. 74.

Newsletter six times a year, and a quarterly journal.³³ The NCCBMI met for the first time in 1975. NCCBMI was initially independent. However, with the recognition that the two organizations had common goals, NCCBMI became a special interest group of ADCIS. In 1978, the consortium published its first Yearbook of Computer-Based Music Instruction as an issue of the above mentioned journal. The yearbook, as well as the regular issues of the journal, provide any institution interested in initiating a CBI project with valuable information concerning current efforts in this rapidly developing field.³⁴

³³The Journal of Computer-Based Instruction, Vol. 6, No. 3 (1980), p. C-8.

³⁴Ibid., p. C-3.

CHAPTER II

CBI COURSE DEVELOPMENT

Skill Objectives

The skill objectives which are the focus of this study are limited to the basics of melodic interval training. Specifically, these are the ability to identify simple melodic intervals, ascending and descending, and the ability to notate those intervals in the bass and treble clefs. The perfect unison is excluded on the assumption that the inability to identify a repeated tone would indicate the need for remedial work prior to interval training. Intervals greater than the perfect octave are herein considered to be in the province of advanced interval training. It is my hope that by concentrating on simple melodic intervals, the student will achieve a mastery of these basic skills which will serve as a firm foundation for further aural training.

Student-Computer Interaction

Hardware which facilitates communication between the student and the computer is referred to as an input or output device. Interaction between the student and the Melodic Interval Course is accomplished by several such devices.

Student input. The student uses one input device, a typewriter keyset which has been partially redefined (see Figure 1). Removable colored stickers placed on the fronts of individual keys are labeled

with the names of all the simple intervals and with the letter names of all the notes in the musical alphabet. Three additional white stickers labeled YES, NO, and REPEAT are also provided.

Computer output. The Melodic Interval Course uses three coordinated methods to communicate with the student: ordinary text, color graphics, and digitally synthesized sound. The control pages, points in the course at which the student controls the program flow, consist entirely of text. Exercises utilize a mixed text and graphics page which allows four lines of writing at the bottom of the television screen. Music notation is presented by means of color graphics, and specific colors are used to indicate correct and incorrect answers. A small digital synthesizer is used to sound the intervals, and the transducer used is a stereo headset.

Course Design

The Melodic Interval Course is a graduated drill master for the notation and aural identification of simple melodic intervals. Four learning activities are involved:

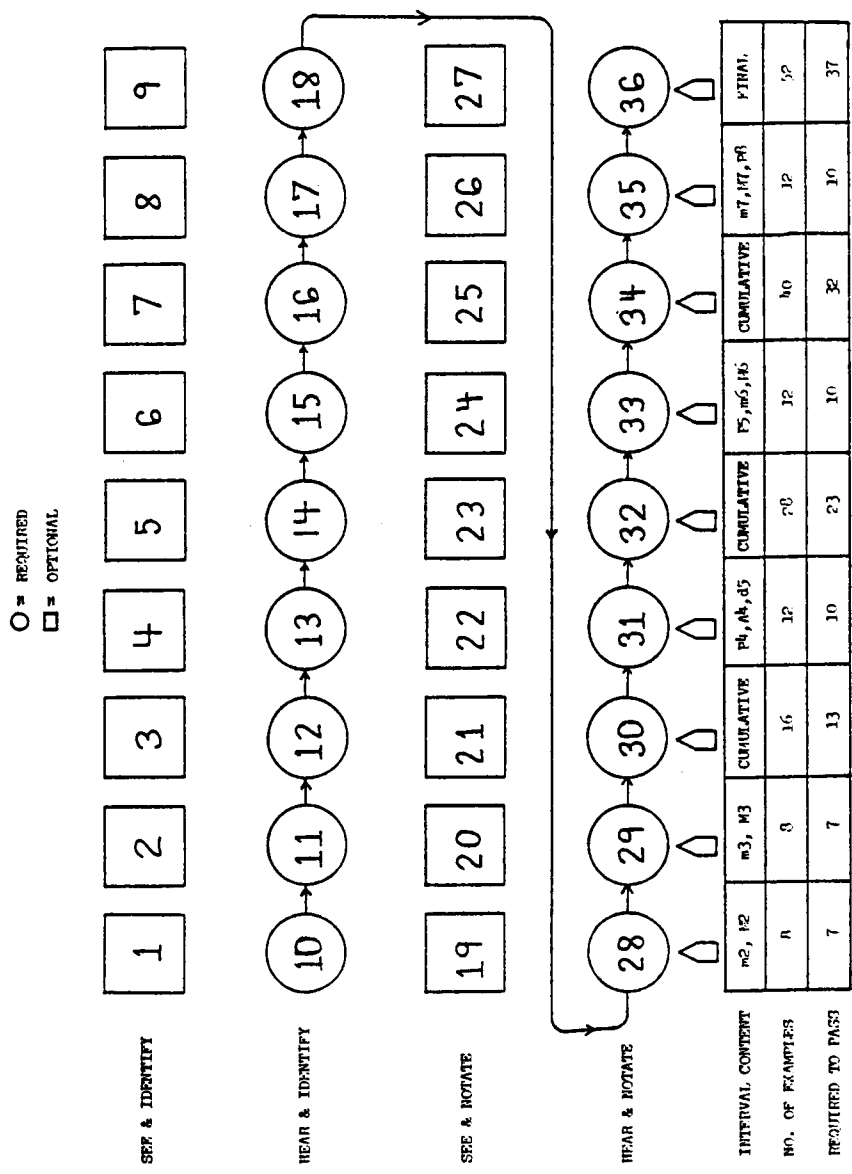
1. See and Identify--a melodic interval is notated on the CRT, the student responds with the interval name.
2. Hear and Identify--a melodic interval is sounded, the student responds with the interval name.
3. See and Notate--one note appears on the CRT and the interval name is given, the student responds with the letter name which would form the given interval.
4. Hear and Notate--one note appears on the CRT and the interval is played, the student responds with the letter name which would form the sounded interval.

In each learning activity, the student must progress through nine groupings of intervals. The first group contains major and minor seconds. The next group contains major and minor thirds, and the following group contains both seconds and thirds. The remaining intervals are introduced in the same manner until the ninth group is reached; it contains all intervals from unison to octave. The student then moves on to the next activity.

The nine groupings in each learning activity result in a total of thirty-six positions in the course which the student must accomplish in sequence. The instructor can also, at his discretion, place the student at any given position in the course, thereby allowing flexibility. For instance, the highest level of the course used alone can serve as a proficiency examination.

Design Change Effected During Experiment

In referring to Figure 2 on the following page, the reader will note that a total of thirty-six exercises are available. The original concept of the course was to place a student at the first position and require him to work his way step by step to the final examination in "Hear and Notate." It was observed during the first few weeks of the study that the control group was being afforded the immediate opportunity to begin work on identification of sounded intervals via the tape recording/workbook method; but the experimental group was being delayed by the necessity of completing the first learning activity, "See and Identify." This disparity was corrected by adjusting the



computer program. The course position of all students in the experimental group was moved to the beginning of the "Hear and Identify" learning activity. Furthermore, the program was changed so that when a student passed the final examination in "Hear and Identify," he was automatically moved to the beginning of "Hear and Notate," thus making the non-sounding activities optional. An advantage is demonstrated by these adjustments. Unlike printed and recorded teaching materials which, once produced, are static, a CBI course can evolve in response to changing needs.

Control of Course Flow

The Melodic Interval Course is linear in design in respect to the student's progress through the eighteen required course positions. In effect, the course does not allow the introduction of new intervals until mastery is gained over already given intervals. With the exception of this one, computer-imposed limitation, the student otherwise exercises considerable control over his work.

Sign-on procedure. A simple sign-on procedure protects each student's record. At the beginning of a work session, a student is asked, via the CRT, to type his social security number. The computer then "looks" on the floppy disk for a student file with a matching number. Having found a match, the computer then asks for the student's first name. If the name given matches the name on the file found by the computer, the student is greeted by name and routed to the WHAT'S NEXT control page. To allow for typing errors, three attempts at

signing on are permitted, after which the program aborts with this message:

PERHAPS YOU HAVE NOT BEEN PROPERLY ENROLLED, PLEASE ASK THE LAB
ATTENDANT FOR ASSISTANCE

The WHAT'S NEXT? control page. This control page is a point in the program where the student may select the following options:

```
TO CONTINUE COURSE TYPE - - - - - C
FOR PROGRESS REPORT TYPE - - - - - P
FOR REVIEW WORK TYPE - - - - - R
TO TAILOR-MAKE AN EXERCISE - - - - T
ERROR FOLLOW-UP - - - - - E
TO SIGN OFF - - - - - S
```

TO CONTINUE COURSE--This option routes the student to an exercise at his current course position. For instance, if a student has a course position of thirty-five and he types a "C," he will automatically be routed to exercise number thirty-six, the final examination.

FOR PROGRESS REPORT--This option routes the student to an information page which shows what he has accomplished and what he has yet to do to complete the course.

FOR REVIEW WORK--This option allows the student to review any exercise already passed.

TO TAILOR-MAKE AN EXERCISE--This option allows the student to build his own exercise of up to fifty examples, with complete control in selection of the interval content, the clef and the direction of each example.

ERROR FOLLOWUP--This option appears on the control page only if errors were made during a previous exercise. Typing an "E" will

route the student to a secondary control page entitled ERROR FOLLOW-UP which offers these options:

ERROR REPORT
SEE AND HEAR EACH ERROR
COMPUTER TAILORED DRILL

The ERROR REPORT displays the number of errors made on each interval, as well as the number of errors which occurred in each clef in each direction.

The SEE AND HEAR EACH ERROR option allows the student to take a detailed look at his mistakes. For each error made on the exercise just completed, the computer notates the incorrect response in red and plays the incorrect response interval. Then the correct response is notated in green and in turn is played. The student can then either repeat the process for that error or go on to the next one.

The COMPUTER TAILORED DRILL prepares an exercise which consists of the errors made on the exercise just completed.

TO SIGN OFF--Typing "S" terminates a work session. The word BYE appears on the screen for fifteen seconds. The course is then automatically routed to the sign-on procedure in readiness for the next student.

Exercises

In this study, the word exercise is used as a general term, referring to a set of examples which may be used either as a drill or as a test.

Generation of examples. With the exceptions of the tailor-made drill and the computer-tailored drill, all exercises are constructed

using a randomizing process. For each interval used in a regular exercise, four examples will occur. These four will be an ascending and a descending interval in both the bass and treble clefs. Once the computer has generated a list of examples using randomly selected starting pitches, with four examples for each interval, it then shuffles that list using a random number generator. The result is an exercise that contains an even distribution of each interval and of the four conditions under which that interval may occur. In addition, owing to the randomizing process, a very high probability exists that the exercise will be different each time it is reconstructed.

Exercise introduction page. A student may arrive at the beginning of an exercise by four routes:

1. By typing "R" on the WHAT'S NEXT? page and subsequently selecting a previously completed exercise for review.
2. By typing "T" on the WHAT'S NEXT? page and building his own exercise.
3. By typing "E" on the WHAT'S NEXT? page and subsequently selecting the computer tailored drill on the ERROR FOLLOW-UP page.
4. By typing "C" on the WHAT'S NEXT? page and being routed directly to the exercise for the next course position.

Regardless of routing, all exercises are preceded by an introduction page which provides information and two options. The information consists of a title which provides the name of the learning activity in which the exercise will be executed, a list of the intervals to be used, and the number of examples. The two options are to take the exercise either as a timed test or as an assisted drill.

The timed test. If the student selects the test mode, he is given seven seconds to respond to each example. Within that time limit, a response may be changed at will. When the time limit runs out, the last response is notated on the CRT. If no response is made within seven seconds, a TIME LIMIT EXPIRED message is flashed on the screen; and the course moves on to the next example.

The assisted drill. In the assisted drill, immediate feedback is afforded the student. The interval may be replayed as many times as desired, and there are two opportunities to respond. Only the first response is scored. The following dialogue between computer and student reveals how the assisted drill uses color graphics, text and sound in the "Hear and Notate" learning activity:

Computer: graphics--a green G flat is notated in the bass clef; text--NAME THE SECOND TONE; sound--an ascending perfect octave is played.

Student: responds incorrectly by typing an E flat.

Computer: graphics--a red E flat is notated on the far right of the staff; text--TOO SMALL; sound--an ascending major sixth is played.

Student: turns page by pushing space bar.

Computer: text--TRY AGAIN; sound--the ascending perfect octave is played again.

Student: responds incorrectly again, this time typing an F.

Computer: graphics--the red E flat is replaced by a red F; text--YOUR ANSWER: G FLAT TO F; sound--an ascending major seventh is played; graphics--a green G flat is notated; text--CORRECT ANSWER: G FLAT TO G FLAT; sound--the ascending perfect octave is played.

Student: turns page to go on to next example.

Prompts. To insure that the student will never be uncertain at any given point, the Melodic Interval Course places instructions on the CRT screen at all times. One or more of these instructions or prompts are printed in inverse text, black text on a white background, on the bottom line of every page:

ESC--The ESC, or escape, key is located on the far left of the keyset. This prompt is present on every page of the course, allowing the student to discontinue any activity at any time and return to the WHAT'S NEXT control page to select new options. By this means, the situation is avoided in which a student may be locked into a computer-controlled environment.

TURN PAGE--This instruction indicates to the student that the course is waiting for him to continue, by pushing the space bar which is labeled TURN PAGE.

MAKE SELECTION--This prompt is used both during exercises and on the control pages. During an exercise, this prompt indicates that the course is awaiting a response of an interval name or letter name. On a control page, MAKE SELECTION tells the student that he should choose an option.

REPEAT--If the REPEAT prompt is present, the student may repeat the interval just played by pushing the key labeled REPEAT.

YES OR NO--These prompts indicate to the student that he should respond to a question using the keys labeled YES or NO.

Coding

The Melodic Interval Course was coded in Applesoft Extended Floating Point BASIC.

Managerial Programs

Two managerial programs were provided for the study by Dr. Donald M. Pederson. These programs relate to the recordkeeping system of the course.

Course clerk. This program is an adaptation of "File Cabinet," which is available free to all Apple II owners through the Contributed Programs series. Using "Course Clerk," the teacher can enter, change, and delete individual student records (see Figure 3). Records can also be sorted alphabetically and numerically. The formatting feature of "Course Clerk" is highly useful, facilitating output of student data via CRT or printer in any format desired.

```
1    SOCIAL SECURITY #: 415786689
2    NAME (LAST FIRST): DOE JOHN
3    COURSE POSITION #: 36
4    SESSIONS: 26
5    EXAMPLES: 3850
7    EXAM  A4: 75
8    EXAM  A3: 89
9    EXAM  A7: 82
10   EXAM  A6: 75
```

Figure 3. Student Record

Update. The "Update" program enables the instructor, or his assistant, to combine the student records filed on two or more disks onto one master record disk. The combined information is then loaded onto the student disks. This simple process, which requires less than five minutes a day, makes it possible for any student to work on any computer at any time. In effect, "Update" is a microcomputer imitation of one aspect of a large timesharing system, in that the same records are available at every student station, allowing the most efficient use of the available hardware.

CHAPTER III

THE EXPERIMENT

The experiment was conducted during the Fall Quarter, 1979, at The University of Tennessee, Knoxville. The pre-test was given on the first day of classes, September 27, and the students began working one week later. The experiment was concluded at the end of the quarter, the total period of time being nine weeks.

Population and Sampling

The subjects involved in this experiment were thirty-six students who were enrolled in the first quarter of a six quarter series of ear training courses. The pre-test was administered to all three sections of this first quarter class. The total number of students who took the pre-test was one hundred and two. On this test, sixty-six students made a grade of less than 50 percent. The names of these students were written on separate pieces of paper and placed in a hat. The first thirty-three names drawn from the hat were assigned to the experimental group, the remaining students were assigned to the control group. The final size of the experimental group at the end of the study was nineteen, while that of the control group was seventeen. The decrease in size of both groups can be attributed to normal attrition and to the A4 screening test.

The Evaluation Instrument

Three tests were used for evaluation. Two of the tests, Test A3a and Test A3b of the Horacek/Lefkoff series, were combined and used as the pre-test/post-test.¹ The third, Test A4, was used as an intermediary screening test. Test A3a is a melodic interval dictation test in the treble clef consisting of 48 examples, with an even distribution of the twelve simple melodic intervals, ascending and descending. Test A3b is constructed in the same manner but is in the bass clef. For each example, an interval was played. The first note was given on the printed examination sheet and the student was required to notate the second note of the interval. Test A4, the screening test, was of the same nature as A3a and A3b. However, only identification by interval symbol (example: m2 for minor second) was required of the student. All of these tests were administered using the materials provided with the Horacek/Lefkoff series, these being recorded examples of intervals played on the piano.² These materials have been an essential part of the ear training curricula at The University of Tennessee for seven years.

Procedure

The syllabus (see Appendix A) provides an overview of the requirements of the course. All students were required to pass the A4 test with a grade of at least 70 percent in order to be allowed to take the

¹Leo Horacek and Gerald Lefkoff, Programming Ear Training, Volume I: Intervals, Harcourt, Brace & World, Inc., New York, 1970.

²Ibid., Tapes 17 and 18.

A3a and A3b tests. Subjects who, for any reason, did not take both Test A3a and Test A3b were eliminated from the study. Elimination of those students in combination with normal attrition, resulted in the loss of sixteen subjects from the control group and fourteen subjects from the experimental group. Two opportunities were provided to take each of the three tests. For those subjects who took Test A3a and/or Test A3b more than once, the higher score is reported in this study. All students in the study had two mandatory one-hour ear training classes per week. All of these classes were taught by the faculty member with immediate responsibility for the ear training program.

The control group. For the control group, work outside of class was accomplished in the music library using the tape recording/workbook materials. These materials provide three types of exercises: melodic interval discrimination, identification, and dictation. No attempt was made to measure or control the amount of work that these subjects did outside of class.

The experimental group. Each subject in the experimental group was scheduled to work on the Melodic Interval Course three times a week, thirty minutes per session. The computer automatically kept records of the number of sessions and the number of examples each student accomplished. Those who missed scheduled sessions were not entitled to receive a grade of incomplete. Subjects were allowed, if they desired, to work more than the three scheduled sessions.

Treatment of the Data

A t-test was used to evaluate the data generated in the study (Table I). The first step was to check for homogeneity of variance between the experimental group and the control group using this formula:

$$F = \frac{Sg^2}{Sl^2}$$

where

F equals the value by which variance homogeneity will be tested
 Sg^2 equals the greater (larger) variance
 Sl^2 equals the lesser (smaller) variance

Then t was computed using the pooled variance t model:³

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\left(\frac{\sum X_1^2 + \sum X_2^2}{n_1 + n_2 - 2} \right) \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$$

The results of these calculations are reported in the final chapter.

³W. James Pophorn, Educational Statistics, Use and Interpretation, New York, Harper and Row, 1967, p. 145.

TABLE I
RAW SCORES AND DIFFERENCES

	Student	Pre-Test	Post-Test	Difference
<u>Experimental</u>				
<u>Group:</u>	1	24	78	54
	2	18	63	45
	3	43	51	8
	4	44	58	14
	5	34	75	41
	6	27	49	22
	7	30	84	54
	8	37	84	47
	9	34	93	59
	10	35	85	50
	11	41	78	37
	12	37	88	51
	13	43	76	33
	14	34	78	44
	15	24	43	19
	16	36	90	54
	17	36	61	25
	18	45	86	41
	19	<u>41</u>	<u>86</u>	<u>45</u>
		663	1406	743
<u>Control</u>				
<u>Group:</u>	1	34	48	14
	2	48	67	19
	3	28	60	32
	4	48	75	27
	5	44	56	12
	6	41	86	45
	7	47	80	33
	8	40	53	13
	9	47	71	24
	10	36	30	-6
	11	18	27	9
	12	31	71	40
	13	22	74	52
	14	32	65	33
	15	35	53	18
	16	33	72	39
	17	<u>33</u>	<u>87</u>	<u>54</u>
		617	1075	458

CHAPTER IV

RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Aural identification and notation of melodic intervals are linked skills which are considered to be fundamental in college-level aural training. Three problems exist in this area of instruction:

1. Present drill methods suffer from various disadvantages. Computer-based instruction offers a remedy for these disadvantages.
2. Excellent aural training courseware is available on some main-frame computer systems but the prohibitive cost of such systems makes them impractical.
3. Microcomputers have now made computer-based aural training an economic possibility, but there is a lack of comprehensive music courseware for these new machines.

The purpose of this study has been to develop such courseware and to compare that courseware to an existing drill method which uses tape recordings in conjunction with a printed workbook.

The Results

The hypotheses of the study are here restated:

Hypothesis number one. There will be no significant difference in variance between the scores of the control group and the scores of the experimental group on the pre-test.

Test of hypothesis number one. The analysis of variance revealed a value of $F=1.19$, indicating that there was no statistically significant difference between variances of the experimental group and the

control group on the pre-test. Hence, the null hypothesis is retained, and the two groups can be considered homogeneous.

Hypothesis number two. The achievement of the experimental group, as measured by the post-test, will not be significantly greater than the achievement of the control group as measured by the same test.

Test of hypothesis number two. The obtained value of t was $t=14.23$. A value of $t=3.8$ would be necessary to reject the null hypothesis at the .001 level of significance. This result indicates that there was a statistically significant difference between the two groups on the post-test. The null hypothesis is rejected, and the experimental group can be considered to have attained a higher level of achievement than did the control group.

Total improvement of both groups. In addition to the statistical measurements just reported, Tables I and II and Figure 4 provide a revealing comparison of the two groups. Table I shows the raw scores on both tests and the differences between them. The figures in the three left-most columns of Table II are the total raw scores of the students in each group on the pre-test and the post-test and the total difference. The right-most column, the percentage of improvement, is derived by dividing the total difference by the total on the pre-test. The result reveals that the experimental group had an total improvement of 112 percent, whereas the control group had a total improvement of

TABLE II
AVERAGE IMPROVEMENT FROM PRE-TEST TO POST-TEST

	TOTALS			
	Pre-Test	Post-Test	Difference	Percentage of Improvement
<u>Experimental Group</u>	663	1406	743	112
<u>Control Group</u>	617	1075	458	74

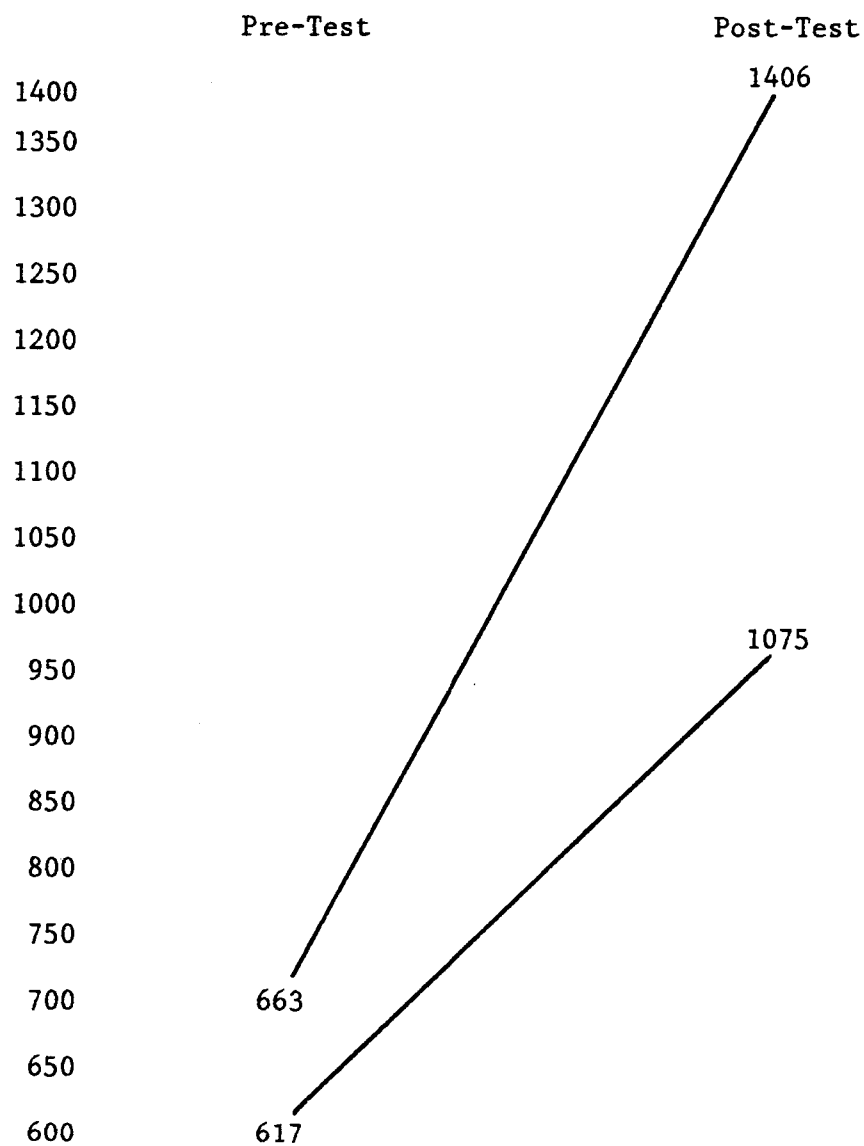


Figure 4. Graph of Improvement

only 74 percent. Figure 4 provides an approximate graphic representation of that improvement.

Recommendations and Conclusions

The Melodic Interval Course. The results of the experiment indicate that the computer-based course is clearly superior to the tape-recording/workbook method. It is therefore recommended that the Melodic Interval Course be adopted at The University of Tennessee, Knoxville, as a standard part of the aural training curricula.

The Apple II microcomputer. Throughout the period of development and implementation of this study, the Apple II microcomputer has proved a reliable and flexible tool. Documentation on all aspects of the machine is thorough and of high quality. Rare malfunctions have been speedily repaired by the local authorized service center. With the addition of the PASCAL programming language, it seems likely that the Apple II will receive widespread use. Lacking a competitor in the market, this microcomputer is recommended for computer-based aural training.

The ALF Sound Board. For the purpose of generating melodic and harmonic intervals, the ALF Sound Board has functioned well. The documentation, software, and graphics which accompany the board are excellent. The critical drawback of this synthesizer is its limitation to three voices. Inasmuch as any complete sequence of aural training must include four voice harmonic dictation, the ALF Sound

Board cannot be recommended for computer-based music instruction. It should be kept in mind, however, that any programs which utilize this synthesizer can be adapted to any other digital synthesizers which are developed to interface with the Apple II.

Record-keeping on microcomputers. The record-keeping system of the Melodic Interval Course utilizes a random access file stored on floppy disk. When a student signs on the course, his individual record is loaded into memory. As the result of a number of modifications during implementation, an effective and efficient record-keeping system has been evolved. A few words of caution are in order regarding the use of such a system with a microcomputer. Two relative shortcomings of the microcomputer must be kept in mind: disk storage on a microcomputer is limited in comparison with disk storage on a mainframe machine, and file access time is slower on a microcomputer than on the larger machine. In light of these relative disadvantages, it is wise to limit the file size of a microcomputer record-keeping system to the bare essentials. The Melodic Interval Course utilizes files with ten entries in each record. The access time on files of this size is entirely acceptable.

The value of such records should not be underestimated. Besides freeing the teacher from the routine tasks of administering and grading tests, the general report which such a system can produce provides a valuable profile of the student's efforts and progress. It is recommended that record-keeping systems be a standard feature of any microcomputer-based music courseware intended for institutional use.

Student-computer interaction: Prompts. A prerequisite for progress in the field of computer-based music instruction is the adoption of standardized conventions. The following suggestion is offered toward that end. It is recommended that brief instructions, or prompts, always be present on the CRT throughout a CBI course. These prompts should be concise yet communicative and should inform the student exactly what options are available at any given time. On the Apple II, I found it most convenient to locate these prompts on line 24 at the very bottom of the screen. It is further recommended that the prompts be printed in inverse text against a black background to increase visibility. In the Melodic Interval Course, these prompts have proven very effective at enhancing the student's understanding of the manner in which the course works, and such understanding is vital if students are to feel comfortable with the computer.

General Conclusions

Increased use of computers as educational devices seems probable within the next five years. Although such a trend may conceivably cause drastic changes in educational concepts, it seems prudent that both coursewriters and the general public should simply regard computers used in this way as interactive textbooks animated through the agency of a human author. To this end, computer-based music instruction must communicate information to students in a manner that avoids obstacles to understanding. At the current stage of microcomputer

courseware development, the only sure method of refining such communication is through a cycle of implementation, revision and implementation, with the coursewriter himself having extensive opportunity to observe students working at the computer. The Melodic Interval Course developed during this study is the product of such a process extended over two years. It is my hope that the study will be of aid in advancing research in the field of microcomputer-based aural training and that techniques discussed herein may prove of value to other music coursewriters.

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APPENDIX A

SYLLABUS OF FIRST QUARTER EAR-TRAINING

MUSIC 1113

Sight Singing and Ear Training

Music 1113 is the first quarter of a six quarter sequence of courses in Ear Training. Awareness of the rhythmic and tonal aspects of music is vital for a convincing performance of music. The development of this awareness is aided by acquiring specific skills in the following areas - rhythm, scales and melodies, intervals, and harmony. The use of the voice, whether verbalizing rhythmic passages or singing melodic passages, is essential for determining if the ear and mind are hearing and retaining accurately. The material in this course will correlate with First Quarter Harmony (1111). We also strongly encourage you to find applications of the material and skills presented to your applied areas. Development of the ear training skills, while important for receiving a good grade in this course, is only a means to the desired end of becoming a complete musician.

Text Books

The required texts for 1113 are Introductory Musicianship by Theodore A. Lynn (also used for 1111) and Programed Ear Training, Volume 1 - Intervals by Horacek and Lefkoff. This is a workbook which requires the use of tapes for drill. All taped materials are found in the Music Library on the 3rd Floor. These materials may be used on the machines in the library. Although the use of the library tapes is not required, it will probably be necessary for 90% of the students to use the tapes sometime during the quarter. Refer to the chart in the Music Library to determine the Cassette number needed for a particular exercise.

Tests and Grades

Three different tests are given this quarter to determine your grade. The first test is on the identification of intervals that you hear on tape and corresponds to Unit A4 in the Horacek/Lefkoff book. The other tests are on melodic interval dictation and correspond to Unit A3 in the Horacek/Lefkoff book. All three tests consist of 48 melodic intervals with one point given for each correct response and no partial credit. All tests will be given a second time at the end of the quarter for the purpose of grade improvement.

The grade scale is given below. Any student transferred to the individualized program who does not complete all three tests will receive an incomplete for the course grade; however a grade percentage of 50% must be achieved on melodic interval identification (e.g., Test A4) or the student will receive an F.

Classes

Class attendance is required on Tuesday and Thursday through the completion of Test A3b. No absences will be excused; after 2 absences, 5 points will be deducted from the student's point total at the end of quarter for each class missed. Students may attend any of the sections of 1113. Students in the individualized program who miss assigned sessions will not be entitled to receive a grade of incomplete.

Participation in class is expected. There will be group singing and verbalization of scales, intervals, melodic sequences and rhythmic patterns as well as presentation and drill of intervals from the Horacek/Lefkoff series.

Test Schedule

Test A4 -- Thursday, October 18
Test A3a -- Tuesday, November 6
Test A3b -- Tuesday, November 20

Retest Day -- Thursday, November 29

Test Record and Grade Scale

TEST	MAX.	#1	#2
A4	48		
A3a	48		
A3b	48		
Total	144		

A	130-144 points
B	115-129
C	100-114
D	95- 99
F	Less than 50% on interval identification (e.g., Test A4)

APPENDIX B

MAJOR REVISIONS OF THE MELODIC INTERVAL COURSE:

INTERVAL DRILLMASTER

Major Revisions of the Melodic Interval Course

One of the main purposes of this study was to design, develop and implement a practical CBI course. As a result of four quarters of regular daily use, several revisions were seen to be essential if the Melodic Interval Course were to be truly practical. To this end the course has been entirely rewritten in Integer BASIC and has been renamed Interval Drillmaster. The following revisions have been incorporated in this new version.

Two versions. The Interval Drillmaster is available in two versions: a record-keeping version for institutions and a non record-keeping version for private teachers and individuals.

Inclusion of harmonic intervals. Harmonic intervals could not be included in the original program due to limitation of memory space. Elimination of the non-aural activities has made possible the inclusion of both melodic and harmonic intervals in the same program.

High resolution graphics. Two graphics modes are available on the Apple II microcomputer: low resolution and high resolution. Low resolution allows the programmer a 40 x 40 point plotting grid. Musical notation created in this mode inevitably suffers from a certain crudeness because curved lines are not possible. On the contrary, the high resolution mode offers a 160 x 280 point plotting grid, allowing realistic, high quality musical notation. Examples of

this notation as used in Interval Drillmaster may be examined in the following paragraphs.

Input modifications. As discussed in Chapter II, the Melodic Interval Course used a redefined keyboard for input. The primary reasons for this approach were to eliminate the need for typing skills on the part of the student and to allow single key responses on timed tests. This method actually worked quite well during the entire period of implementation. However, it became apparent that, if the program were to receive general distribution, an input method using standard equipment would have to be devised. The method chosen utilizes the game controller, supplied with every Apple II, and only one key of the typewriter keyset. That key is the ESC or escape key.

The game controller consists of a rotating knob or dial and a simple push button. In the Interval Drillmaster, the dial is used to move a pointer on the screen. The pointer may be one of four things: the word SELECT, an arrow, a green rectangle, or a whole note. In all four applications, the push button on the game controller is depressed in order to enter the selection when the pointer is positioned in the desired place.

The first application, the word SELECT, is on the control pages. The student uses the dial to align the word with the option he wants. The second application is during interval identification exercises. The interval names are printed on the screen in high resolution graphics, and the arrow can be moved to point to the student's choice.

The third and fourth applications are found in interval dictation exercises. In these exercises, a stationary note is printed on the staff, the interval is sounded, and a second note is printed on the staff. This second note can be moved using the dial. In Figure 5, the lower note is stationary, but the higher note can be moved.

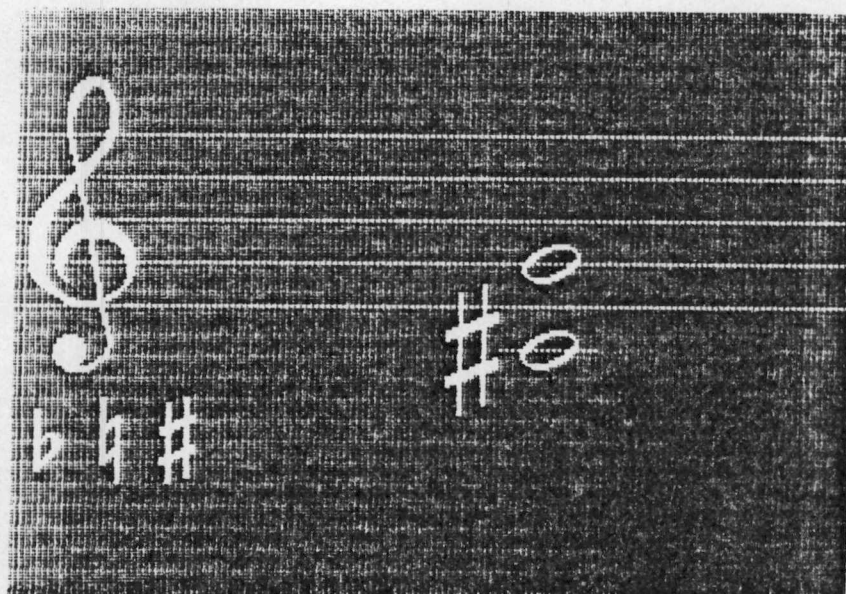


Figure 5. Select note.

After the note has been selected, a green rectangle appears surrounding one of the symbols in the accidental table located underneath the clef. The dial will now move the green rectangle to surround the desired accidental (see Figure 6).

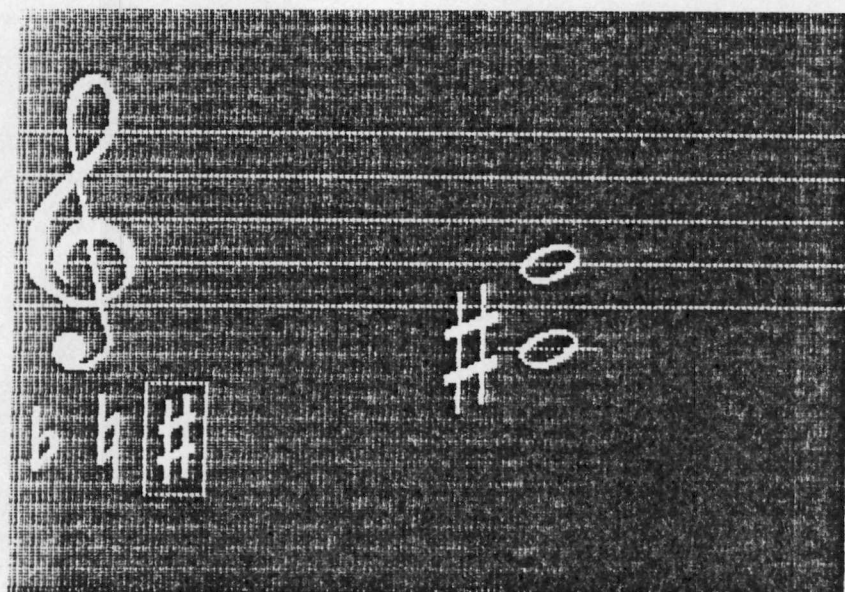


Figure 6. Select Accidental

In Figure 7, the student has selected a sharp as an accidental for the G. The Interval Drillmaster automatically repositions the sharp on the C in compliance with the conventions of musical notation.

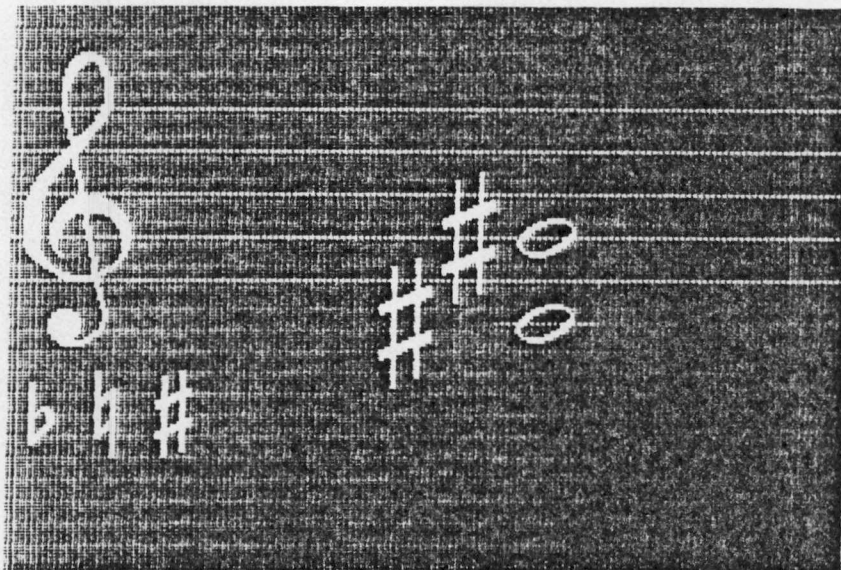


Figure 7. You may change selection.

As stated previously, the ESC key is the only key used on the typewriter keyset. This key possesses the same function in the Interval Drillmaster that it did in the Melodic Interval Course: it offers the student the constant opportunity to abort any activity and return to the WHAT'S NEXT control page to select a different option.

VITA

Gerald W. Chastain, Jr., was born in Shreveport, Louisiana, on May 2, 1947. He was raised in Chattanooga, Tennessee from the age of two. He attended elementary schools in that city and was graduated from Chattanooga High School in June 1965.

After an eight-year tour of duty with the United States Air Force, which included six years in the Panama Canal Zone, he was admitted to the undergraduate program at The University of Tennessee, Knoxville, in September 1974. He received the Bachelor of Music degree with a major in Composition in June 1977.

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The author is a member of Pi Kappa Lambda. Mr. Chastain has been awarded a Graduate Teaching Assistantship at the University of Wisconsin, Madison, and will begin doctoral work in August 1980.