# PRODUCTION AND EVALUATION OF A COMPUTER-ASSISTED LEARNING PROGRAM IN MUSIC

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A Thesis Equivalent

in

The Department

of

Education

(Note that five audio-cassettes, the CAL courseware code and the CAI source listing constitute part of this thesis equivalent).

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## ABSTRACT

# PRODUCTION AND EVALUATION OF A COMPUTER-ASSISTED LEARNING PROGRAM IN MUSIC

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With the aid of the computer, we attempted to develop the
learner's capacity to recognise (aurally) various musical styles. Given
a cassette-player, a number of tapes containing musical examples and
access to a computer terminal, the student tried to achieve four instruc-
tional objectives.

A computer-assisted learning program was designed and imple-
mented for university students within the music program. The learner
received and occasionally chose questions which were displayed on the
computer terminal. Explanatory material generally preceded each question.
The program's impact was determined by testing it on a student sample
from Concordia University. Both testing and instructional material
were incorporated into the computer-assisted learning program.

On the average, each student in the experimental group spent
three sessions of one to two hours per session at a computer terminal
in order to complete the lessons and tests. The control group, who did
only the tests, spent one session at the terminal. The findings indicate
a statistically significant gain ($p < .05$) in learning. The pre-specified
instructional objectives were attained by 80% of the students in the
experimental group.

# ACKNOWLEDGEMENTS

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# CHAPTER 1

## INTRODUCTION

### 1.1 CONTEXT AND STATEMENT OF THE PROBLEM

Computer-assisted instruction (CAI) for the purpose of concept-learning involves a highly individualized relationship between a student and a CAI program. If the concepts to be taught are within the musical domain, then an additional element is introduced into this relationship — the aural stimulus. Hence, such stimulus patterns presented to the learner are contingent upon the nature of the CAI program-learner relationship. The presentation of the aural stimuli through an audio device can be <u>controlled by the learner</u> who selects the appropriate stimulus pattern in accordance with the type of information received from the CAI program.

The teaching of music is being positively influenced by the use of listening laboratories similar to those widely adopted for the teaching of foreign languages (Spohn, 1963).

CAI programs of the 'drill and practice' type have been implemented for the teaching of such basic musical material as scale construction and melodic intervals (Tarratus and Spohn, 1967). More complex CAI programs are currently being developed with the aim of perceiving, manipulating and ultimately generating musical structures (Bamberger, 1973).

The approach used here was to allow the student as much latitude as was technically possible in expressing his immediate perceptions

of a piece of music. The program would then point out cogent stylistic features in the music; hopefully reinforcing and clarifying those initial perceptions.

In dealing with conceptual material, it was out of the question to model an instructional system simply on a 'yes-no' type of response pattern. It was of utmost importance not to restrict the learner's development by restricting the opportunities for choice.

The instructional system used was basically of the tutorial type with some attempts to achieve conversational status. The following features were incorporated:

1. Active student responses

2. Analysis of responses and immediate feedback

3. Branching according to programmed criteria

4. Co-ordination of aural and visual stimuli.

The costs of operating a CAI System, per student, is high, except when used by large numbers (in the hundreds). The cost diminishes when an on-line system already exists, as is the case at Concordia University. The evidence that CAI is an effective learning system is gradually accumulating (Bamberger, 1973; Cropley and Gross, 1970).

Among the future developments for CAI are the design of terminals which allow for a greater or larger variety of display capabilities including graphics. This would make possible the illustration of musical notation and scores on a screen of a terminal device. On-line audio units with graphic output already exist at the University of California and Stanford University (Atkinson and Wilson, 1968).

The essential problem, as was seen in the above-mentioned context was as follows:

Will a CAI program, with the aid of recorded materials and given the present technical constraints, significantly help students learn concepts in musical style through the attainment of specific instructional objectives (rf. Section 2)?

## 1.2 REVIEW OF THE LITERATURE

Due to the multi-disciplinary nature of this study, a number of different subject sources had to be examined:

1. General CAI material

2. Music instruction through CAI

3. Teaching strategies as applied to music; particularly in the fields of aural perception and stylistic analysis.

CAI programs in music have already been developed in order to help students play an instrument. Spohn (1963) indicated how slight pitch variations in the sound of a clarinet, as played by a student, can be detected by the computer. This information with corrective hints was then fed back to the learner.

A system of programs in the study of music was implemented at Stanford University (Kuhn & Allvin, 1967). Among these programs, was one in the field of sight-singing where the learner had access to an audio unit. Each note of the learner's performance was sampled and compared to the correct version. The resultant data was reduced statistically in order to decide whether a specific exercise was to be repeated, whether the student was to go forward in the program or whether he was to repeat similar material for additional practice. As a result of an experiment on this system, it was found that the subjects reported an increased awareness of pitch differences as indicated in a criterion test.

Deihl (1971) described a CAI program in instrumental music that concentrates on the areas of phrasing, articulation and rhythm for intermediate clarinet players at the secondary school level. The CAI system itself included a projector for displaying notated musical examples, a cathode ray screen for visual output and an audio play/record unit. The student responded with a light pen or a typewriter keyboard. The light pen is an electrical device whereby one can modify information displayed on a screen.

In the teaching of music, one can use:

1. exclusively positive examples

2. exclusively negative examples (that is, examples of concepts related to other styles)

3. both positive and negative examples.

Haack (1972) demonstrated that a mix of both positive and negative examples yielded higher results by students on a musical style discrimination test. However, it was suggested that there should be a preponderance of positive examples. Unfortunately, a more precise relationship between the number of positive and negative examples, including an optimal sequence, has not been investigated.

Hullfish (1972) dealt with a comparative study of two CAI programs in music theory. The adaptive branching type program was based on a history of the learner's previous responses, whereas the Markov branching type program made use of the last response only. The results of the study showed that, at the comprehension, application and analysis levels of the cognitive domain, there was a marked improvement in learner performance when using the adaptive branching type program. In fact, the

percentage of correct responses increased from 57.8 for the Markov branch-ing type program to 81.0 for the adaptive branching type program. The overall time needed to complete the material was approximately the same for both types of programs.

Finally, Bamberger (1973) demonstrated a program which allows students not only to learn musical structures but to generate and test their own structures. The learner is seated at a terminal that is linked to a computer and a 'music box' unit that can produce sounds under his control. The student can then construct a melody out of a group of motives and phrases. After listening to his results, he can re-arrange the phrases as he desires. Thus, through an active listening and construction process, new musical structures can be generated as many times as is deemed neces-sary.

## 1.3 EDUCATIONAL NEED FOR A CAI PROGRAM IN MUSIC

The Music Department at Concordia University is developing an audio resource area, including a sound-bank and some visual equipment. The sound-bank consists of tapes and cassettes that are catalogued and cross-referenced by cultural area, historical period and style. Guide analysis sheets accompany each tape. The musical materials involved cover a wide spectrum of cultures and styles ranging from Asian music to contemporary American music and electronic music. Each item of music on a tape emphasises a particular aspect such as melodic shape or instru-mental quality. Very often, one specific aspect is examined across a group of cultures, historical periods and styles. The cross-referenced index helps one in seeking out common principles governing widely varying

musical styles.  The resource area will include:

1. tapes and cassettes - basic listening resource

2. film strips - viewing musical events within a cultural context (used in conjunction with recorded tapes)

3. colour slides - similar in use to film strips

4. guide analysis sheets - used in conjunction with recorded tapes

5. texts - general usage

6. two synthesisers - used for experimentation in musical composition

7. tape-recorders - used as a listening device

8. cassette-recorders

9. instruments (piano, harpsichord, etc.)

10. overhead projector and transparencies - used to display musical scores.

A CAI program, that elucidates a musical area such as style characteristics, will contribute to the present development taking place within the Music Department insofar that it also uses an integrative, cross-cultural approach to musical styles.  The student can spend as much time as he deems necessary in order to achieve the instructional objectives of the CAI program.  Recorded cassette-tapes and a cassette-recorder form part of the materials in this program.  Consequently, the student can listen to a recorded example as many times as he feels is necessary for aural comprehension.  There is <u>no overall time limit</u> for completion of any section within the CAI program.  For each objective of the program, <u>a variety of audio materials and procedures</u> are available to each student.

The type of recorded musical example (i.e., whether it is of the review type or not) is decided <u>on the basis of his past performance</u>. Each student works towards the attainment of an objective <u>at his own rate</u>. This is made possible through the computer time-sharing system which allows many students to proceed through the same CAI lesson at different speeds (Allvin, 1971). Finally, each student's progress is measured by comparing his performance with a specific criterion objective rather than with the performance of other students.

A CAI program could be useful to teachers as one of many cross-referenced media packages where courses have a flexible structure and allow for a number of instructional options.

From a student's perspective, the availability of such multi-media packages as a CAI Music Program with audio tapes will provide him with the tools whereby he can exercise his musical-perceptive skills to good advantage. These skills are thus developed through learning experiences that are not possible elsewhere.

## 1.4 OVERVIEW OF THIS STUDY

After having established a need for a computer-assisted learning program, it was necessary to predict those benefits which would accrue from such a program. Thus, a research hypothesis for this study was constructed.

Prior to designing a CAI program that would meet those needs that have been established, a set of goals towards which the program could aim was specified. At this stage, it was possible to list a number of instructional objectives that the learner should attempt to achieve

in order to realise the goals of the CAI program. These objectives were operationalized and broken down into terminal and enabling types. An analysis of those tasks necessary to design and implement the CAI program was then made.

The type of learning activities that would take place as a student interacts with the CAI program was specified. An assessment of the cognitive and motors skills required in using the terminal was made. An instructional strategy for the program was designed in which a modest degree of learner control was incorporated. Criteria for evaluating the student's responses were established at this time.

The teaching points for the CAI lessons evolved out of the instructional strategies and these provided the basis for designing the program steps. At this point, it was possible to make a list of the relevant musical examples to be used. The cassette tapes were subsequently recorded so that each musical example 'tied in' with the program step that made a listening request. The program steps were converted into a coded form using the CAI language called 'CITCAN'. The coding was then keypunched on a terminal and entered into computer storage.

The CAI program was tested for reliability and validity and a formative evaluation was subsequently made. As a result of the evaluation, a number of modifications were made to the program. A time schedule was set up for running the CAI program accompanied by an inventory of costs.

The experimental operation of the program was prepared with the voluntary participation of an experimental group and a control group. After these groups had completed the required sessions at the terminal, the pretest and posttest scores were collected for purposes of data

analysis. The results of the experiment were examined in order to deter-mine whether the experimental hypothesis was to be refuted or not.

# CHAPTER II
## HYPOTHESIS, GOALS AND OBJECTIVES

## 2.1 STATEMENT OF THE HYPOTHESIS

### MAIN HYPOTHESIS:

Informally, the hypothesis is that a CAI program in music, using recorded materials and given present technical constraints (see Appendix A) significantly helps students understand concepts in musical style.

Formally, the main hypothesis was formulated as the following null hypothesis for purposes of experimentation:

There is no significant difference in learning, as measured by both the pretest and posttest, as a result of taking two CAI lessons in musical style.

It is the null hypothesis that was tested in the implementation of the experimental design.

Those musical concepts to be grasped arise out of an aural-descriptive view of styles. This particular approach towards musical styles is more fully described in Sections 3.2 and 3.4. Mastery of the concepts in musical style is demonstrated when either instructional objectives number one, two and three or instructional objectives number one, two and four have been achieved. The criteria for achieving these instructional objectives are described in Section 2.3.

SECONDARY HYPOTHESIS

The null hypothesis is that significant differences in
pretest-posttest gains are due to different levels of aspiration
as manifested in marks obtained on regular music course examin-
ations.

The null hypothesis was tested during the implementation of the experimen-

tal design.

## 2.2  GOALS OF THE CAI PROGRAM

The goal of this CAI program was to develop, in the individual,

that capacity to aurally recognize a particular musical style through

the perception of cogent distinguishing features in the music.  It is of

utmost importance to be capable of perceiving commonalities inherent in

musical styles (i.e. contemporary rock, Mozart, etc) that are derived from

Western European sources.

The ability to compare and contrast the following musical attri-

butes from various musical sources was considered as prerequisite to style

recognition:

1.  Repetition and sequencing of note groups
    in melody
    in accompaniment - ground, ostinuto, figured bass

2.  Use of contrast

3.  Rhythmic pattern

4.  Tonal relationships

5.  Textural change and dynamics

6.  Subjective factors, i.e. degree of tension, relaxation

7.  Melodic shape
    - contour
    - disjunct, conjunct step motion

8.  Sound quality or timbre - instrumental, vocal

9. Harmonic framework

10. Meter and tempo

11. Space and direction of sound

12. Subsidiary attributes
    - time of day
    - smell
    - tactile qualities

The overall goal, as defined above, was then broken down into a number of sub-goals:

a. The student can perceive, classify and react to stylistic features.

b. The student can verbalise information regarding musical concepts and styles.

c. The student possesses a working knowledge of important characteristics of various musical styles.

d. The student can make rational choices in musical situations in deciding the merits of a piece of music.

e. The student thinks about a musical work, <u>not in terms of pre-conceived labels</u>, but in the context of its stylistic features.

f. The student is made aware that <u>repeated and attentive listening</u> to music is the only possible source of perceiving and comprehending its nature. <u>Visual substitutes (texts, notation) will not, in itself, suffice</u>, as they only give one a vague idea of what it might be like to have a direct perception of musical sounds.

## 2.3 INSTRUCTIONAL OBJECTIVES

Given a cassette-player, five cassette tapes of pre-recorded examples and access to a computer terminal, the student should achieve

the following instructional objectives:

TERMINAL OBJECTIVE #1 - To correctly identify at least six out of ten features in a piece of music. This should be done in the form of typed input to a computer terminal. The identification of these features should take place within ten minutes.

TERMINAL OBJECTIVE #2 - On listening to two musical examples, the student will describe those stylistic differences occuring between them. A satisfactory description will consist in the identification and use of three features in each example.

TERMINAL OBJECTIVE #3 - On listening to three musical examples of approximately 16-20 measures in length, the student will note two common factors appearing fh all examples. These factors will be displayed in the form of typed input to a computer terminal.

TERMINAL OBJECTIVE #4 - On listening to three musical examples (16 bars each), the student will compare and contrast them from a stylistic point of view. He will also note those features that are used differently from one example to another.

In order to achieve these instructional objectives, the student was provided with a cassette recorder and five cassette tapes containing the

recorded musical examples for use with the CAI program. The student was not provided with music notation or text as stress was placed on aural perception of the music. However, each individual was free to consult musical scores or texts if he so wished.

In order to achieve any one terminal objective, the attainment of a time-dependent set of enabling objectives were deemed prerequisite (Mager, 1962). A general list of enabling objectives were formulated as follows:

(note that these objectives are not listed in chronological order. A schematic diagram indicating time-dependancy appears in Figure 1.).

ENABLING OBJECTIVE #1 - On listening to a piece of music of approximately 8 measures in length, the student will indicate whether an even or uneven rhythmic pattern occurs.

ENABLING OBJECTIVE #2 - On listening to a piece of music of approximately 12 measures in length, the student will specify the type of textural change taking place.

ENABLING OBJECTIVE #3 - On listening to a piece of music, 20 measures long, the student will list the types of instruments used.

ENABLING OBJECTIVE #4 - On listening to two musical examples, the student will identify at least two features which are similarly treated in both examples.

ENABLING OBJECTIVE #5 -  On listening to three musical examples,
the student will identify at least two features which are sim-
ilarly treated in all examples.


ENABLING OBJECTIVE #6 -  After having listened to two pieces of
music, the student will compare the use of melody in both
examples.


ENABLING OBJECTIVE #7 -  After having listened to two pieces
of music, the student will indicate which example makes use
of phrase repetition.


ENABLING OBJECTIVE #8 - On listening to a piece of music of
12 bars in length, the student will identify and describe
three features in the music.


ENABLING OBJECTIVE #9 -  On listening to three examples of
musical excerpts, the student will be given a particular feature
and will indicate how it is used in all examples.


ENABLING OBJECTIVE #10 -  On listening to three examples of
music, the student will be given two features and will indicate
how they are used in all examples.

The following schematic (See Figure 1) illustrates the hierarchal rela-
tionship of dependancies between enabling and terminal objectives.

# FIGURE 1

## ENTAILMENT GRAPHS FOR INSTRUCTIONAL OBJECTIVES



Terminal Obj. #1

Terminal Obj. #2

Terminal Obj. #3

Terminal Obj. #4
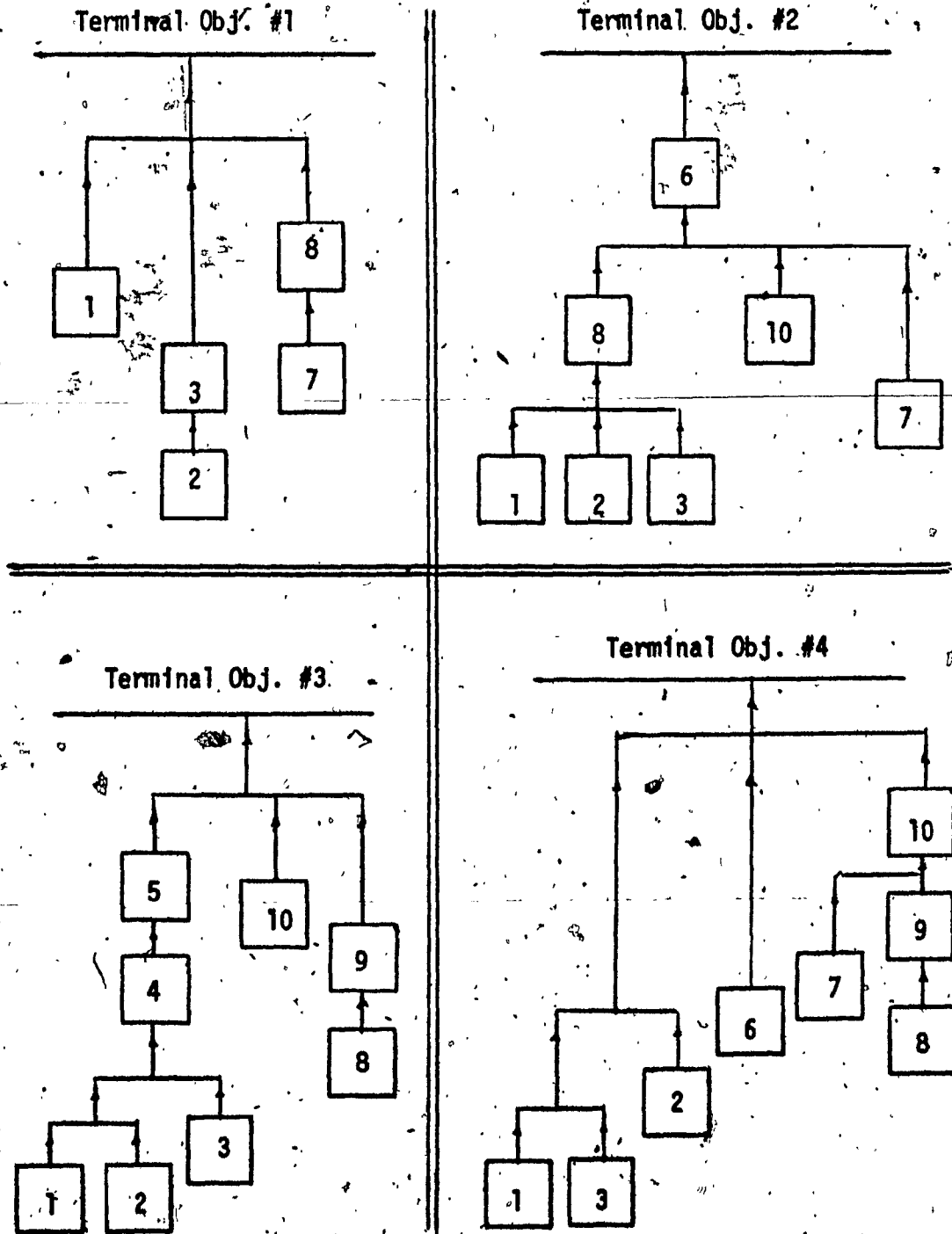
Note: The numbered squares refer to enabling objectives (see pages 14 and 15).

## 2.4  TASK ANALYSIS

The series of procedures that were necessary in order to plan, implement and evaluate the CAI program were established and broken down into the following tasks (see Figure 2.)

Phase A has already been described in Sections 2.1, 2.2, and 2.3.

Phase B and C were carried out as parallel tasks. In other words, the establishment of criteria for the pretest and posttest questions occured during the planning stage of the instructional strategies for the CAI program. Section 3.0 describes the basic strategies used in the CAI program.

# FIGURE 2

## STEPS REQUIRED FOR THE IMPLEMENTATION OF THE CAI PROGRAM

**PHASE A**

- Specify goals, sub-goals
- Identify student charact.
- List constraints within the environment

- Draw up an hypothesis
- Specify terminal objectives

- Design the learning hierarchy
- Specify enabling objectives

- Decide what steps have to be revised

**PHASE C**

**PHASE B**

- Establish criteria for test items
- Plan an instructional strategy
- Evaluate the program

- Design Pretest and posttest
- Fill out forms-course outline -teaching point

Revisions ?

- Select proper audio materials
- Debug the program

Yes

No

- Specify the detailed program steps
- Run pilot tests
- Run the program -Expt. group -Cont. group

(A)

- Write out the program in the CITCAN language
- Evaluate the results (see hypothesis)

- Draw up conclusions on the program
- Collect and reduce the data

# CHAPTER III
## INSTRUCTIONAL MATERIALS AND STRATEGY

### 3.1 ANALYSIS OF LEARNER ACTIVITIES

Underlying every task is a complex set of pattern operating in the various psycho motor, cognitive and affective domains of communication. Our first aim was to identify those typical situations that were representative of the circumstances indicated in the statement of objectives (see Section 2.3).

Such situations can be broken down as follows:

1. Aural perception of sound patterns.

In a typical situation, the student listens to a recorded example of a piece of music and notes how the music is articulated in terms of phrases. A list of recorded examples can be seen in Appendix B.

(Psychomotor, Cognitive)

2. Interpretation of the sound patterns.

The student extracts cogent features among the sound patterns.

(Cognitive, affective)

3. Recall of past knowledge.

The student brings to mind his knowledge of particular styles and features that predominate in each style.

(Cognitive)

4. <u>Search for a suitable response</u>.

    The student examines the question and provides what he believes to be the correct response.

<div align="right">(Cognitive)</div>

5. <u>Re-formation of response</u>.

    The student re-structures his response to comply with the format of the CAI program.

<div align="right">(Cognitive)</div>

6. <u>Typing out the response</u>.

    The student types his response on the keyboard of the terminal device.

<div align="right">(Psychomotor, cognitive)</div>

    Involved in the first three steps were important aspects of concept formation. Musical examples from various styles were cited contiguously and information as to their common features were printed out on the terminal. In this manner, similarities or differences among various styles were pointed out to the student. In one particular case, the student is instructed to listen to examples from both rock music and Mozart. He is, at the same time, given information regarding the similarity of harmonic structure in both examples.

    Each example heard by the student involves a cognitive process of verbal chaining. After he has listened to a musical example within a fixed segment of time, the musical material is then broken down and learned in parts (i.e. - Melodic Line ⟶ Phrases ⟶ Motives). It is necessary in longer or more complex examples to listen repeatedly, two or three times, in order for verbal chaining to take place. Aural

retention of a recorded musical example must take place before any comparative analyses with other examples take place.

As Skinner (1961) has noted, "Teaching machines do not simply provide information for the learner as a textbook would, but provokes the learner into various activities."

In a similar sense, the computer does not merely act as an information-retreival tool but also induces the learner to take part in a number of activities that involve cognitive and psychomotor skills. Some of these activities have already been described. During the test phase of the CAI program, the learner was situated in an environment where he had access to both a terminal device and a cassette recorder with tapes. As the results of the program evaluation (see Section 5) have shown, the students were able to read and interpret what was printed by the computer on the terminal. After some prior instruction by the experimenter, he was also capable of typing his responses accurately on the terminal keyboard.

Each student was able to operate a cassette recorder in order to listen to the recorded examples as instructed by the CAI program. In some cases, a preliminary session of 10 minutes was necessary to advise students on how to use the cassette recorder in an efficient manner. The response time at a computer terminal was limited to only ten minutes.

The accurate typing of words on the terminal was stressed as the CAI program accepted only one mispelled letter in a word and would otherwise reject a response because of mispelling or incorrect punctuation.

Each student worked in a cubicle or small room which contained

a computer-terminal, a cassette-player, a headphone and five tapes. These materials were in close proximity to each other (see Figure 3). There was no electrical control link between the cassette-player and the terminal. Consequently, the student could control the cassette-player more reliably and cheaply than an electrical control link.

The tape recorded examples were closely coordinated with the questions printed out on the terminal device. A reference number for each recorded example was included on both the printed output and the audio tape (see Figure 4).

## 3.2 INSTRUCTIONAL STRATEGY

In order to understand the overall concept of 'style', one should have mastered many concepts and the relationships between them, which are, in effect, principles upon which the subject is based. One indication of understanding is being able to talk, or freely verbalize about the subject. This is best exemplified by requiring the student to define terms and state principles. Another indication of understanding is being able to apply the terms and principles to actual listening experiences; in other words, to recognize examples of concepts. The instructional strategy within the CAI program was based fundamentally on enabling students to attain pre-specified instructional objectives through integrating principles in musical style with appropriate recorded examples.

The initial material presented by the CAI program indicated to the learner the instructional objectives of the subsequent unit of instruction. Thereafter, for each unit, the instructional objectives were

# FIGURE 3
## PHYSICAL LAYOUT OF THE INSTRUCTIONAL ENVIRONMENT
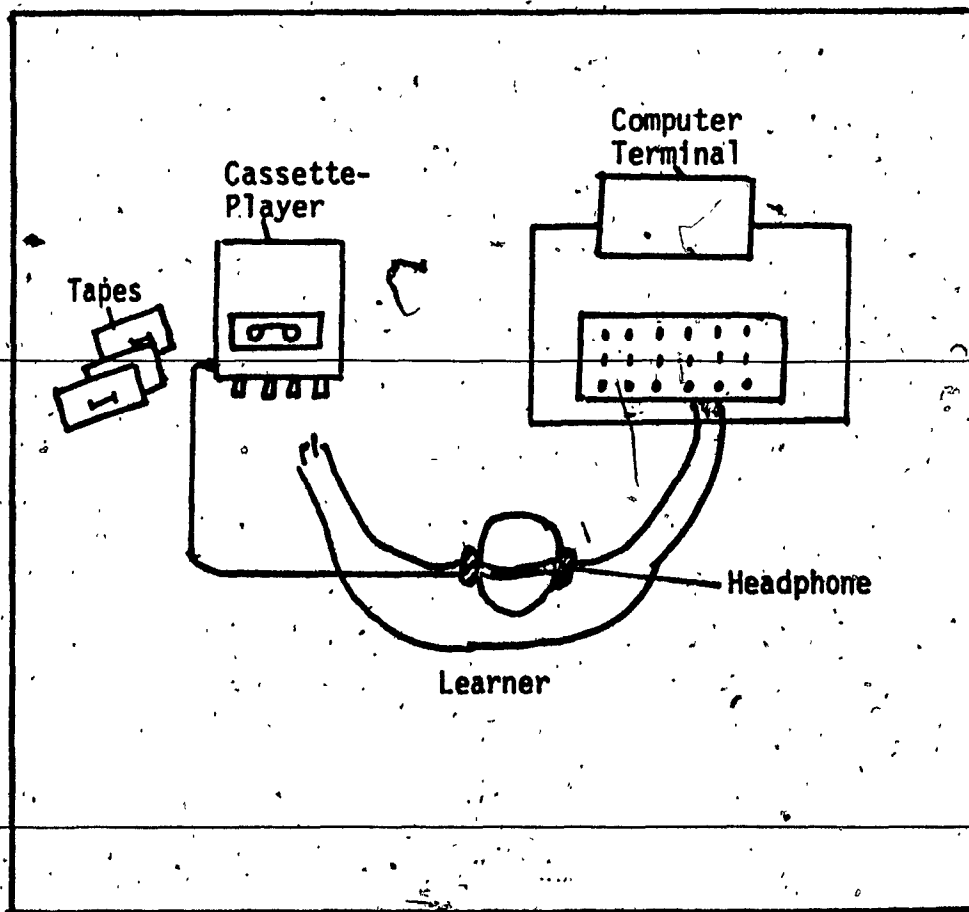
# FIGURE 4

## NUMERICAL REFERENCE TO A MUSICAL EXAMPLE

Please listen to
Recorded Example
No. 21 on tape 3

Printed Output

Recorded Voice

This is Recorded Example No. 21

Ex. 21

Cassette Tape #3

specified. The material was structured in such a way that <u>the student</u> <u>was urged and guided to 'discover' rather than merely assimilate'</u> musical concepts and principles. As the student listened to musical examples and searched out relevent features, he was engaged in the process that would hopefully yield meaningful results.

Question texts were designed to produce a reasonable variety of replies by the student (Placek, 1974). Where choice-type questions were included, a minimum of three possible replies were listed. Thus, one reduced the 50% probability of guessing correctly as would be the case for 'Yes-No' or 'True-False' type questions. In most cases, however, the student had to initiate his own answer, rather than select one of a given list of possible answers.

In most cases, included in the question text, was a request to listen to one or more recorded examples on a cassette-recorder. In some cases, a voice-over-track emits prompts in varying degrees of strength which depend upon the amount of progress that the learner has made. A wide range of student responses were taken into account, as a result of which the student was branched to a section of instructional material most suited to his current needs. When responses were examined by the computer program, decisions for the next step were made on the basis of:

1. The reasons typed in by the student.

2. The student's belief in the correctness of his response.

3. The student's appraisal or misappraisal of the relative importance of the instructional objective concerned.

For example, a student who responded incorrectly to a marked degree would be branched to a section of remedial material including pertinant listening examples.

## MODEL OF A TEACHING POINT

The following model briefly illustrates the sequence of events that took place upon the presentation of a question to the learner:

Text appears on the terminal:-

| | |
|---|---|
| Teaching Point | An even rhythmic pattern occurs when a group of beats (making up a rhythmic group) is repeated continually without any basic changes to that group |
| | Listen to Recorded example #5 on Tape 3. |
| Recorded Ex. #5 | (Voice over track points the rhythmic group and its repetition.) |

## QUESTION APPEARS ON THE TERMINAL:-

(Aim – to insure that the learner can aurally identify an even rhythmic pattern.

Listen to recorded example #7 on Tape 3. Was the rhythmic pattern in this piece of music even or uneven? —Why?

## LEARNER TYPES IN HIS RESPONSE

If the response was 'even' and the reason given was valid, the student would continue on to the next question of the teaching point. If he had responded incorrectly, the student would be given some review material based on the nature of the response given.

As we have noted, the strength of the prompt was contingent on the learner's previous responses. Correct responses were acknowledged and reinforced where necessary.

As the student gained in understanding of a particular concept, the strength of the prompt was gradually diminished. For example, a question in an earlier phase of the lesson would appear as follows:

---

Please listen to recorded examples No. 5 and 6 on tape 3. There are two common features in both examples related to musical time.

Name these features.

---

Note that the number of responses are given. During a later phase in the lesson, a similar question would be posed with less hints. This is illustrated as follows:

---

Please listen to recorded examples No. 10 and 11 on tape 3. Name those features that are common to both examples.

---

Note that, in this case, the number of responses and the temporal relationship are not specified.

Prompts were not withdrawn too quickly from one question to the next but reduced gradually. Otherwise, a sudden increase in the number of incorrect responses could have resulted.

When it is determined that a student has not learned a particu-

lar concept, one or more of the following reasons are likely:

1. The student did not sufficiently attend to the presented information

2. He did not have the pre-requisite knowledge to allow him to digest the new material

3. He misinterpreted the information that was presented to him

4. The information given to the student was ambiguous and allowed for more than one meaning.

Depending upon the evaluation of the student's failure to respond correctly, there are a number of ways to remedy the situation. In the CAI program, the student may be asked to repeat a particular section of the lesson. He may also be asked to review the same information in a different form of presentation. In critical cases, he would be asked to review the information in another medium (i.e. texts, programmed manuals,...). Then again, the student might be required to re-examine the information at a lower level of presentation. That is, in a more expanded form using a simpler vocabulary and syntax.

We have mentioned a number of instructional strategies and the manner in which these were implemented into the CAI program. Previous studies (Anderson and Faust, 1967; Newkirk, 1973; Placek, 1974) have demonstrated the need for some student control as one proceeds through a CAI lesson. Hence, a modest degree of student control was also included in this program and involved the following areas:

1. Choice of content

2. Learning strategy

3. Complexity of the content.

For example, the student would be asked to indicate how many review exercises he would like to do. If he responds correctly to a particular exercise, he would be asked if he would like a more difficult example of the same concept. Conversely, if he had difficulty in grasping a particular concept, he would be asked if he would like an easier example to do (Judd, 1970).

Students were given the option, at a number of points within each section (or unit), to either leave the program temporarily or continue to the next unit (see Table I). This allowed the student some flexibility in choosing the amount of time convenient to him that was, to be spent in one session.

In addition, students were also given the option of skipping portions of a unit. This option was useful for the following reasons:

1. The student, for example, had completed a portion of a unit when a communication fault occurred. Instead of repeating the same material again, the student may use the skip option.

2. The student, for example, had ended the previous session at the middle of a unit. He may, in the current session, enter at the beginning of a unit and use the skip option in order to arrive at the point where he had terminated before.

Table II indicates the location and branch points of the skip options.

TABLE I

## EXIT LOCATIONS IN THE CAI PROGRAM

| UNIT | LOCATION |
|---|---|
| Entry-Behaviour | After Ques. 5 |
|  | After Ques. 10 |
| Pretest | After Ques. #5 |
|  | After Ques. #10 |
|  | After Ques. #15 |
|  | After Ques. #20 |
| CAI Lesson, Part I | After Ques. #5B |
|  | After Ques. #9 |
|  | After Ques. #12D |
| CAI Lesson, Part II | After Ques. #17 |
|  | After Ques. #21 c |
| Posttest | After Ques. #10 |
|  | After Ques. #20 |

## Table II
## SKIP OPTIONS WITHIN THE CAI PROGRAM

| UNIT | LOCATION OF SKIP OPTION | LOCATION OF BRANCH |
|------|------------------------|--------------------|
| Entry-Behaviour | Before Ques. #1 | Before Ques. #4 |
|  | Before Ques. #4 | Before Ques. #7 |
| Pretest | Before Ques. #1 | Before Ques. #6 |
|  | Before Ques. #6 | Before Ques. #11 |
|  | Before Ques. #11 | Before Ques. #16 |
| CAI Lesson, Part I | Before Ques. #1 | Before Ques. #4 |
|  | Before Ques. #4 | Before Ques. #7 |
|  | Before Ques. #7 | Before Ques. #10 |
| CAI Lesson, Part II | Before Ques. #13 | Before Ques. #16 |
|  | Before Ques. #16 | Before Ques. #19 |
| Posttest | Before Ques. #1 | Before Ques. #4 |
|  | Before Ques. #4 | Before Ques. #6 |
|  | Before Ques. #6 | Before Ques. #11 |
|  | Before Ques. #11 | Before Ques. #16 |

## 3.3 AURAL MATERIALS

The aural material for the CAI program consisted of five sets of cassette tapes, each set consisting of five tapes. Each student had access to one set of tapes. Each cassette tape contained a pre-recorded group of musical examples identified by sequence numbers:

    TAPE #1 - Entry Behaviour Section
             Examples #1 to 4

    TAPE #2 - Pretest Section
             Examples #1 to 35

    TAPE #3 - CAI Lesson
             Examples #1 to 46

    TAPE #4 - CAI Lesson
             Review Examples #1 to 25

    TAPE #5 - Posttest Section
             Examples #1 to 35

The musical examples were initially recorded on seven inch reel magnetic tapes from: a) live musical sources   b) tapes   c) and records. The magnetic tapes were then used as masters from which the sets of cassette tapes were copied. The copying process was done at CIT.

A description of the musical examples on each tape is given in Appendix B.

## 3.4 VISUAL MATERIALS

The visual materials consisted of musical information displayed either on a CRT screen or a teleprinter. This information could be divided into the following categories:

1. the specification of instructional objectives
2. background information
3. presentation of the teaching point
4. explanatory information
5. the question text
6. the analysis of answers.

The specification of instructional objectives that were presented on the terminal are listed in section 2.3.

The source of much of the background information came from texts that deal with the subject of musical styles. It should be added that most texts analyse style from a historical and chronological viewpoint. Textbook chapters neatly divide the spectrum of musical style into such segments as Medieval, Renaissance, Baroque, Roccoco, Classical, Romantic and 'Modern'. The more adventerous will structure each stylistic period on a hierarchal basis that moves from the general period style down towards the personal individual styles that may, in fact, be in conflict with each other.

Lang (1941) thoroughly describes those social and cultural changes that contribute to the establishment of a new musical language. Unfortunately, many assumptions are made with respect to the cultural context of style that have been subsequently proven invalid. Pauly (1965) briefly examines the social background to music of the eighteenth century and demonstrates how changes in form arose partly from new social needs. Nevertheless, he neglects to relate content to form in any rigourous manner and thus his analysis remains fragmentary and incomplete.

Blume (1970) goes into considerable depth in discussing the Classical and Romantic style periods. He examines, within each style, such features as rhythm, harmony, tonality and theme. Bamberger and Brodsky (1969) are two of the few writers that incorporate an aural-descriptive method which examines particular features across a broad spectrum of historical periods, cultures and styles.

In our introduction to the CAI lesson, the question of what exactly comprises a musical style was examined. Particular and general styles were cited by suitable examples. A hierarchy of styles (Rosen, 1973) was shown to emerge at any one particular point in the time-space matrix (See Figure 5).

A style evolves through the use of various techniques which are really manipulations of musical features. Some of these features would be:

1. textural change
2. melodic shape
3. the sound space
4. subjective factors
5. sound quality
6. rhythmic pattern
7. tonal (atonal) relationships
8. vertical organisation of sounds (harmony)
9. repetition or contrast of sound groups
10. dynamics.

None of the above features can be treated in isolation. Therefore, the interactions that occur between various features are particularly stressed (i.e. sound quality and textural change).

FIGURE 5

THE TIME-SPACE MATRIX OF MUSICAL STYLE
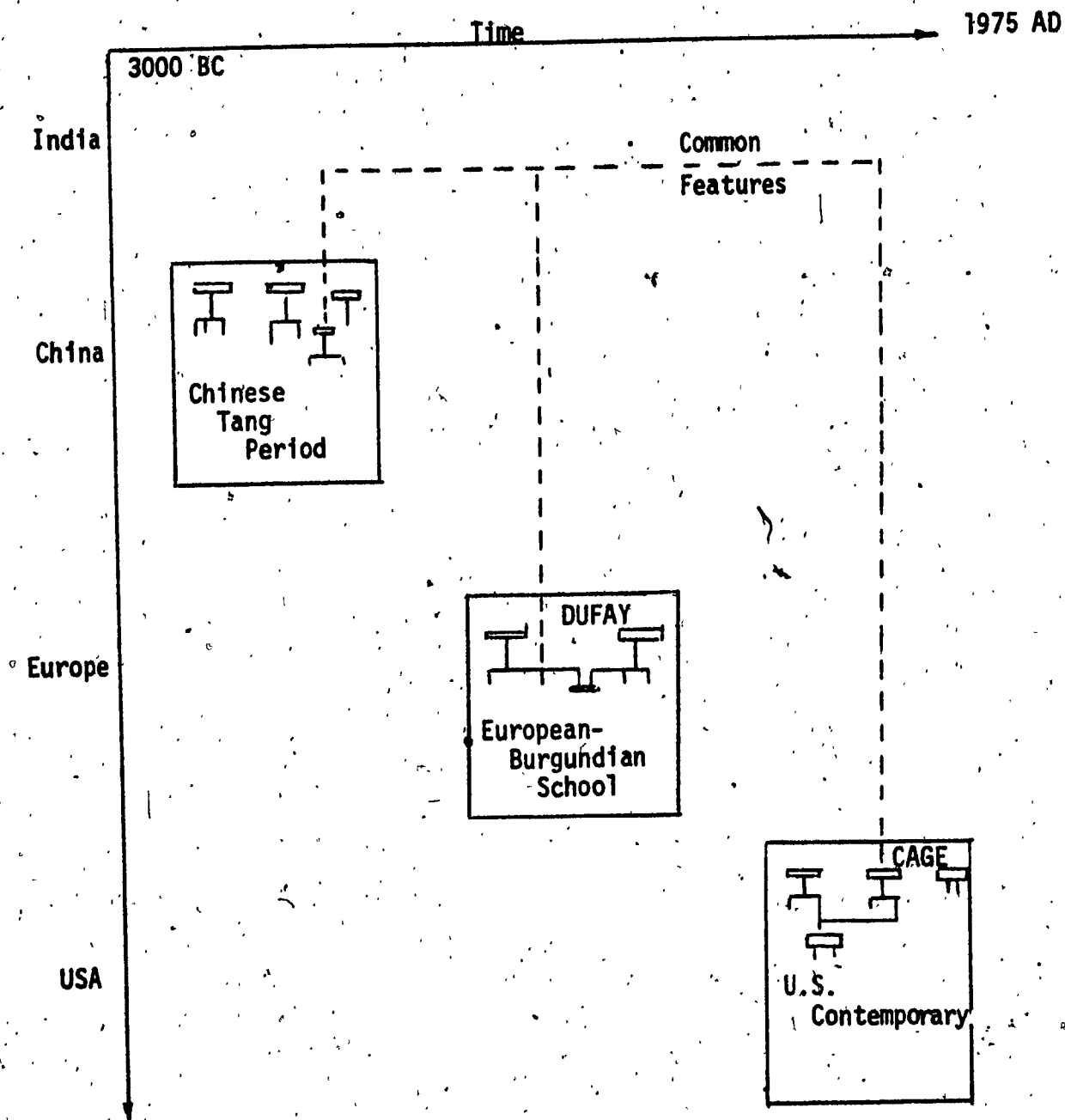
Initially, the student was required to identify and describe the nature of particular features after having listened to one or more musical examples on the cassette-tape. The student then identified common features among a group of recorded examples. An extensive amount of musical material from diverse cultures and historical periods were recorded on tape.

The CAI program attempted to delineate the parameters of a style through a number of features that enable one to <u>distinguish one musical style from another</u>. The most important aspects of a style are those features which the composer takes for granted (Meyer, 1967). These are the norms of a style. Thus, the program demonstrated how style is a type of language that is expressed through a set of norms (LaRue, 1970; Rosen, 1972).

Emphasis was not placed on the notational aspect but on the aural experience of the music. The cassette tapes, used in conjunction with this project, contained enough recorded examples required to explain each of the teaching points that were designed.

A number of meetings were held between the author, who designed the instructional material, and Prof. P. Cohen of the Music Department during which some important concepts related to musical style were discussed.

Once the instructional objectives of the CAI lessons were established, a set of teaching points were designed and transmitted onto forms entitled "Course Outline to Teaching Point" (COTP). From each teaching point, a group of program steps were generated and then translated into a CAI language code called 'CITCAN' (See Figure 6). This process is more

# FIGURE 6
## PREPARATION OF INSTRUCTIONAL MATERIALS
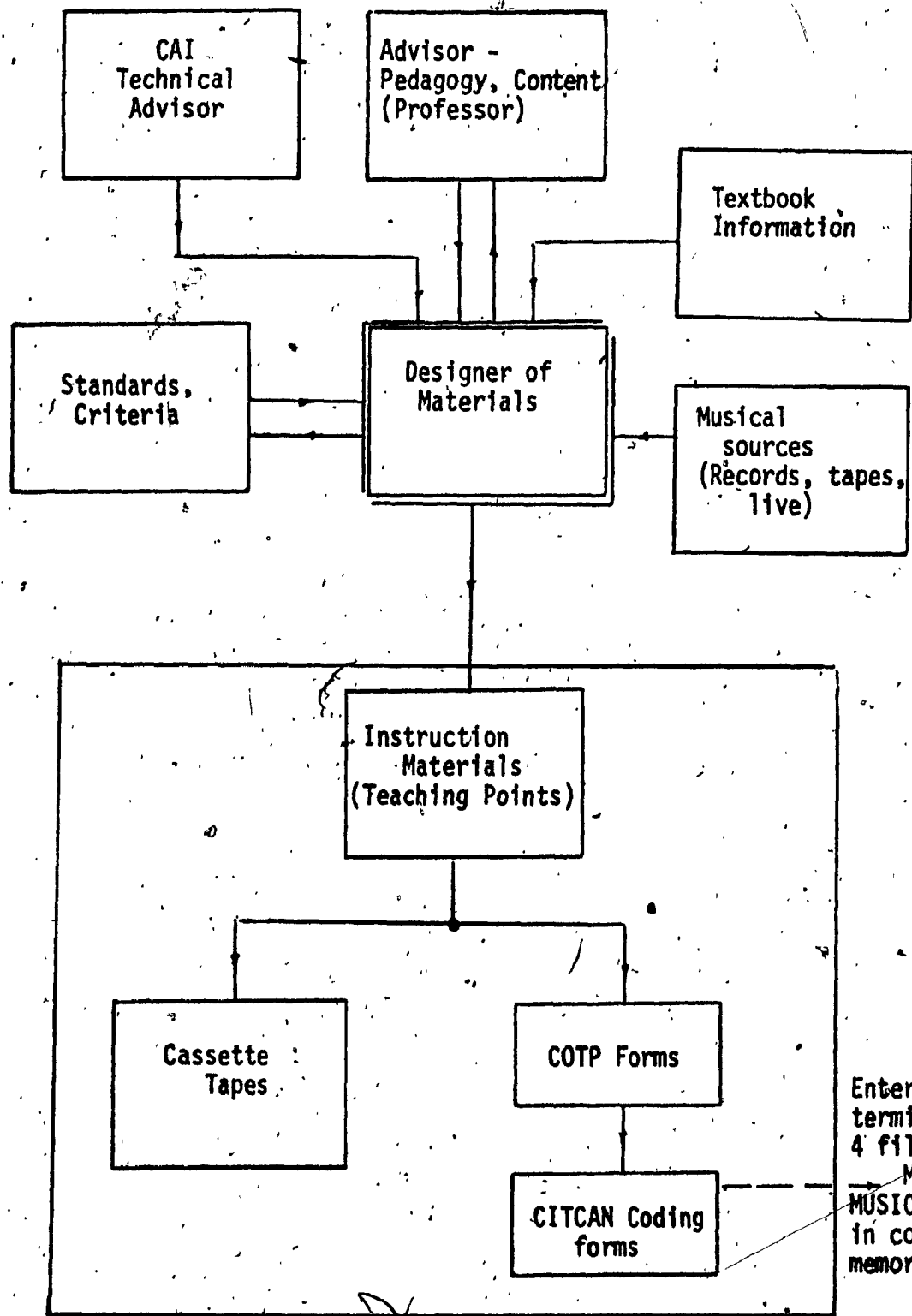
fully described in the next section.

Instructions for listening to the appropriate musical examples were issued within the question text. For example, if a message -

---
Please listen to recorded example No 12 on Tape 3 .
---

appeared on the terminal device, the student would wait until the remainder of the text has been completed. This would be indicated by the character, '?', appearing at the extreme left-hand side of the paper.

The student then pressed the button, 'PLAY', on the cassette recorder in order to listen to the musical example. One could also move the tape forward by pressing the button, 'FORWARD'; or one could backspace the tape by pressing 'REWIND'. The button 'STOP' arrests the tape's motion. The student was allowed ten minutes to listen to a recorded example, and answer the related question. It was of utmost importance to respect this time limit as the CAI program would become unavailable to the student if the ten minute limit was exceeded. A schematic of the student's activities of the terminal appears in Figure 7.

# Figure 7
## STUDENT ACTIVITY AT THE TERMINAL

**TIME**

Explanatory Text
- - - - - - - - - -
Please listen to
Recorded Examples
No. 23 and 24 on
Tape 3.
- - - - - - - - - -
Question is posed ?
(End of text)

Less than
10 min.

Student Activity
Listens to Example 23

Listens to Example 24

Student Activity
Types in response
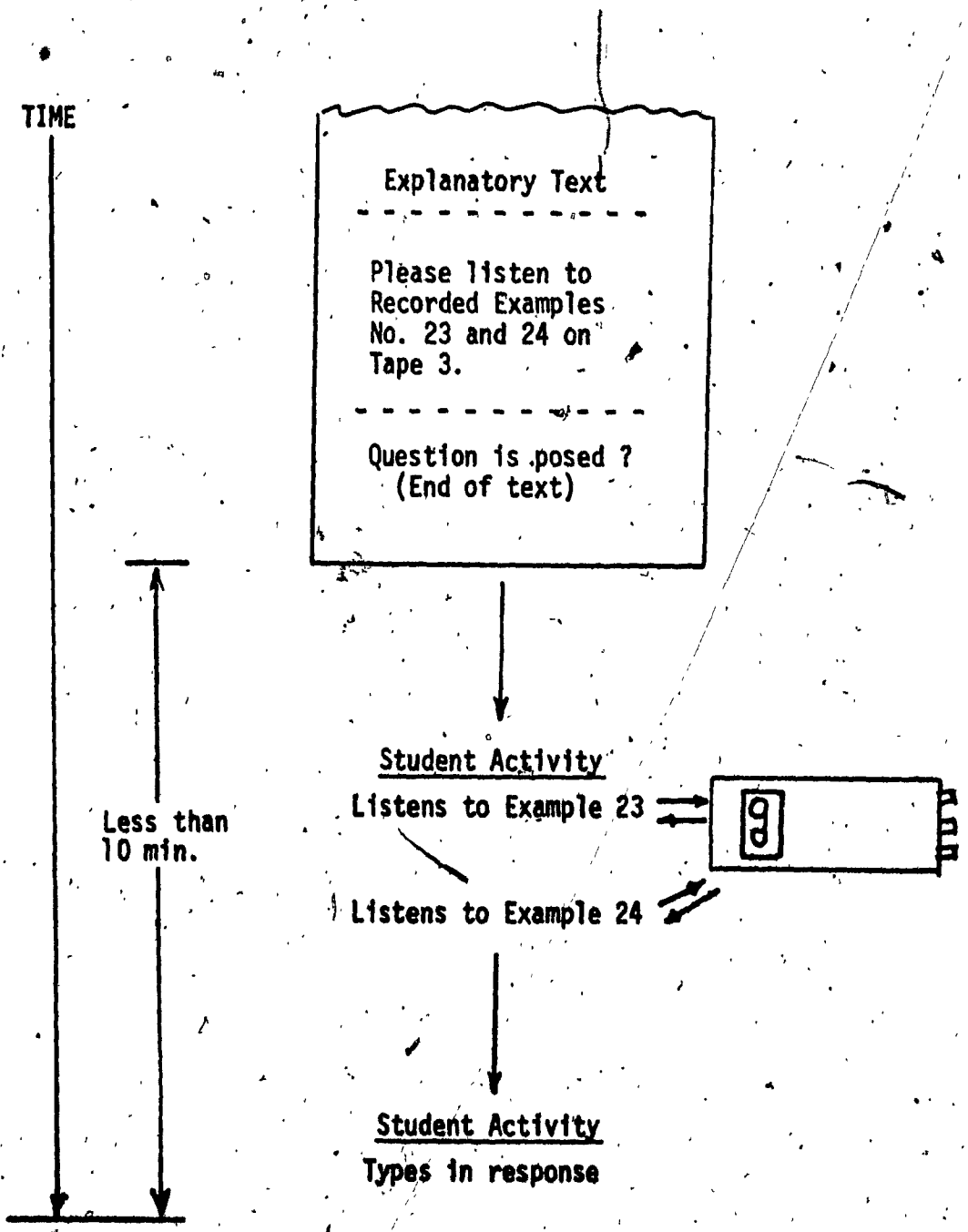
# CHAPTER IV
## PRODUCTION OF THE CAI PROGRAM

### 4.1   THE MODEL AND LESSON DEVELOPMENT PLAN

The model for the CAI program was based upon the characteristics of those individuals that would use the program, the instructional activities generated by the program, and the expected results to be derived from the program (see Figure 8).

Figure 9 illustrates how the two CAI lessons were developed.

### 4.2   CAI MODE

Among the various CAI Modes that were examined for possible application to this program were the following:

1. DRILL AND PRACTICE. This mode is applied mainly for the acquisition of basic skills and simple concepts. It is meant to supplement the regular curriculum taught by the professor. Thus, this mode was generally rejected since the subject content implies a building up of concepts from the simple to the more complex. However, this mode was used in part of the 'Entry-Behaviour' section of the program where basic skills in the identification of musical scales were sampled.

# FIGURE 8

## INPUT, ACTIVITIES AND OUTCOME

| AVAILABLE INPUT | INSTRUCTIONAL ACTIVITIES & ORGANIZATION | ANTICIPATED OUTCOMES |
|---|---|---|
| Prospective Learners | CAI lesson - parts I & II | Meeting individual needs |
| music     students | | Different levels of musical ability are presumed |
| Attitudes | TTY Messages | |
| based on preliminary survey | | Attitude Change |
| | | Determined by Student Evaluations |
| Teacher, Advisor | Cassette Player | |
| Instructional Programmer | Recorded Material | Competency Acquisition |
| | | Based upon the degree to which the objectives were realized (Pretest, Post-test results) |

# Figure 9

## MODEL FOR CAI LESSON DEVELOPMENT



Performance of an instructional task

skills, knowledge

Student ← Lesson Development ← Instructional Programmer

Feedback Loop

Performs task Analysis

Computer-based Instructions ← Teaching Strategies    Learning Theories
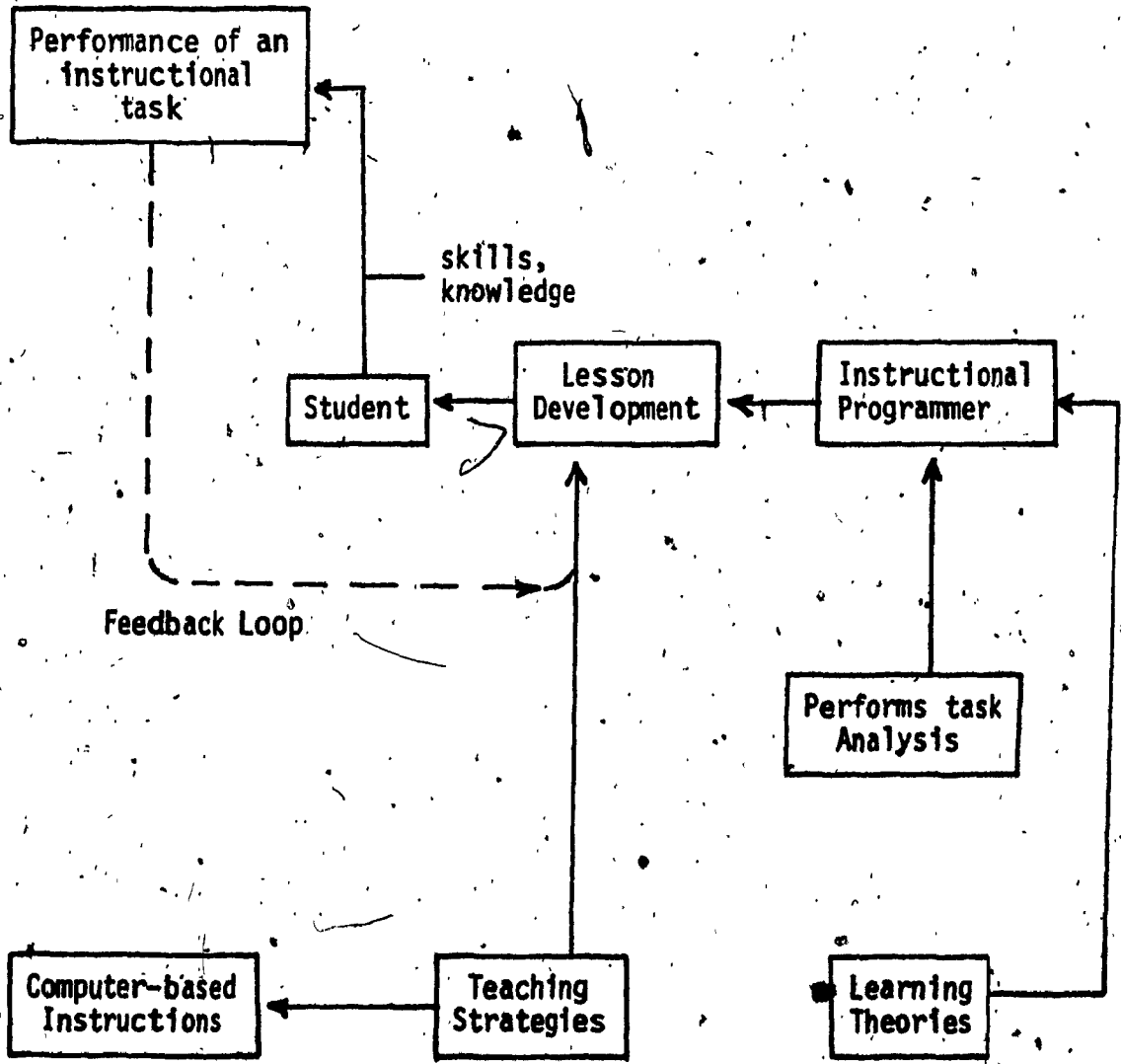
2. <u>TUTORIAL TYPE</u>. In this mode, there is a more sophisticated level of interaction between the learner and the computer program. Cognitive skills are gradually built-up until the point where a particular concept can be comprehended. As soon as the learner manifests a clear understanding of a concept, he is then gradually introduced to a new higher-level concept. Certain basic skills such as the manipulation of a cassette-recorder are assumed. This mode was used very frequently in this program, particularly in these areas where concepts were being formulated.

3. <u>DIRECT DIALOGUE</u>. This mode permits the individual to conduct a restrictive form of dialogue with the computer program. In fact, he is really interacting with the predetermined logic framework of the program as designed by the instructional programmer. The program language, CITCAN, that was used to construct the CAI program, only allows for a limited form of dialogue based primarily on key-word or phrase searches within the learner's response statement. Nevertheless, some use was made of this type of mode in the program, particularly in those areas where the student had a number of options as to subject content or type of exercises. This mode was also used where attitudes were sampled.

4. <u>SIMULATION AND ARTIFICIAL INTELLIGENCE</u>. Modes such as simulation or artificial intelligence could not be considered as highly sophisticated CAI languages were not available at the university. Thus, the question of their applicability in this program would not have been feasible.

## 4.3 DESIGN ELEMENTS

In order that the learner master those tasks necessary for achieving pre-specified objectives, a number of teaching stragegies have been designed. A description of the strategies applicable to the CAI program is given in Section 3 (pp. 33 to 45). The teaching strategies were necessary in order to provide information for designing the branch locations and the branches themselves within the CAI lesson structure. Explanatory notes, remedial material and repetition were also incorporated into the program as a result of the teaching strategies that were established.

The form 'Course Outline to Teaching Point' (COTP) was used to specify all the information required to move from course objectives down to the lowest instructional level of the CAI program which was the 'program step' (Silvern, 1970). A set of teaching points were described in terms of a particular objective. Subsequently, a group of program steps were outlined for each teaching point. The COTP forms were designed at CIT in Concordia University (see Figure 10).

A flow diagram that schematically illustrates the logical sequence of events in the CAI program was constructed (see Appendix C).

The teaching point pertains to the smallest structural amount of knowledge, skills or attitudes that is directed towards the student. A chart was included with each teaching point (see Table III). This chart, entitled DIG-LOP, indicates the relationship of the teaching point to the instructional objective (the DIG section) and the level of perform-ance that was expected (the LOP section). One slot in each section of the chart would be checked off.

## FIGURE 10

### COURSE OUTLINE FORM

| COTP1 | | |
|---|---|---|
| COURSE NAME MUSIC 2 | UNIT CAI LESSON I | STRATEGY TYPE PROGRAM CONTROL |
| DEVELOPED BY IRV ELTENBOGEN | DATE May 25, 1974 | |
| ADVISOR Dr. Gary Boyd | TECHNICAL ASSISTANCE Kirk Tirney | PAGE 40 OF 95 |

| OBJECTIVE | STRATEGY | TEACHING POINT | MEDIA TYPE | PROGRAM STEP | STEP TYPE | SEQUENCE NUMBER |
|---|---|---|---|---|---|---|
| (Terminal Obj. #1) To describe those features which predominate in European Music written during the past 200 years. | Entry | To describe the use of the motive as a generative device for melodic construction. | Computer terminal (TTY or CRT screen) | **Text** Information on the various usages of motives. | Info | 142 |
| | One feature – a) East Europ. folk b) Viennese Classical | | Cassette Tape #3 Ex.#13 (Polish Folk Song) | Instruc. learner to listen to 2 music extracts on Tape #3 | List | 143 |
| | Commonality Generation of melody through motivic-variation | | Ex.#14 (Beethoven Symp. #5) | Explanatory remarks | Expl | 144 |
| | Listen to 2 examples | | Staff (Score optional) | Ques.#6 To detect common usage of motive in both examples. Answer. | Gener | 145 |
| | QUES. Learner's reply | | | 1. COR-Acknow. Go to next ques. 2. Inc.1 – Go to Remed. section. 3. Inc. 2 – Go to Expl. Section | Regen. | 146 |
| | 3. Answer Search | | | | Crit | 147 |
| | | | | | Inq.1 | 148 |
| | | | | | | 151 |
| | | | | | | 154 |
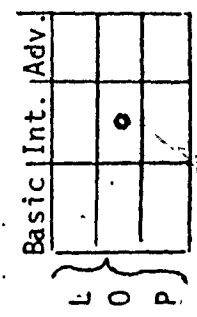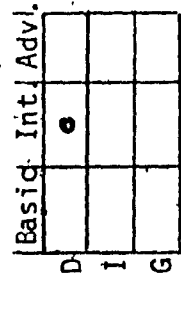
## TABLE III
## DIG-LOP CHART

| | | BASIC | INTER. | ADV. |
|---|---|---|---|---|
| **DIG SECTION** | D | | | |
| | I | | | |
| | G | | | |
| **LOP SECTION** | H | | | |
| | A | | | |
| | L | | | |

The columns, BASIC, INTER. and ADV. specify whether the material presented in the teaching point is of a basic, intermediate or advanced nature respectively.

D  -  indicates that a teaching point is directly related to an objective. This type of teaching point cannot be removed without seriously disrupting the entire lesson.

I  -  indicates that the teaching point is indirectly related to the objective. It is important but not essential to the learning of the lesson.

G  -  indicates that the teaching point is generally related to the objective. It may provide background material that contributes in breadth to the lesson.

The LOP section of the chart indicates the level of performance expected from a particular teaching point. In the top row, entitled 'H', one expects a high level of performance; that is, a maximum of 20% of the questions yielded unacceptable responses. The middle row, entitled 'A' signifies an average level of performance. 60% to 80% of the questions should yield correct responses. In the bottom row, entitled 'L', one expects a low level of performance.

The term, MEDIA TYPE, in the COTP form (See Figure 10) refers to the resources being used in conjunction with a particular teaching point. The following resource types were used:

1. TTY - Teletypewriter, telex or CRT terminal

2. CASS - Cassette recorder.

3. NOTE - Note paper

4. STAFF - Staff-music paper.

The 'STEP TYPE' (see Figure 10) refers to a micro-instructional portion of the program. The following step types were incorporated in the CAI program:

INTRO - the first step of a teaching point.

GENER - Generates text to the student.

REGEN - Elicits regeneration from the student in the form of a typed answer. (Maximum of one line).

CRIT - Tests whether or not a student has assimilated the material. This step branches to two or more of the following steps:

    a) Acknowledgement text

    b) Explanatory text

    c) The same material (repeat)

    d) A remedial question

    e) Listening exercises.

LIST - Initiates a request to listen to a musical example.

EXPL - Generates explanatory text.

INFO - Provides background information.

    - Provides text to a missing answer.

WARN - Generates a warning or cautionary message (i.e. as a result of a mis-typed answer).

ACKN - Acknowledges a previous answer.

REMED - Generates a remedial question.

LOGIC - Internal program logic.

Prior to the execution of a branch to another portion of the program, the following tests were made on the student's reply to a question:

COR - Correct answer

INC - Incorrect answer

UN - Unanticipated answer

MIS - Incomplete answer

~ COR - Almost correct answer

POS. COR - A possible interpretation

SAME - Same answer as in the previous example

DIFF - Different answer from the previous example

DON'T KNOW - (self explanatory)

A number of branch criteria, other than those listed above, were incorporated into the program (Hicks & Hunka, 1972). These criteria made use of the facility whereby a history of previous responses were examined. For example, a 'level code' was generated as a result of examining a series of previous answers related to the identification of stylistic features. The following case illustrates how a value for the level code is derived:

| LEVEL CODE | CRITERIA |
|---|---|
| 5 | The student can identify three or more stylistic features in a piece of music after one listening experience. |
| 4 | The student can identify two stylistic features after one listening experience. |
| 3 | The student can identify one feature after one listening experience. |
| 3 | The student can identify two features after two listening experiences. |

| | |
|---|---|
| 2 | The student can identify one feature after two listening experiences. |
| 1 | The student can identify one feature after three listening experiences. |
| 0 | The student cannot identify any stylistic features in less than four listening experiences. |

To summarize, a number of design elements were built into the CAI program in order to enable the student to master those tasks that helped him achieve pre-specified objectives. A group of teaching strategies were designed through which the question texts were built up. These strategies provided for adequate branching techniques to a number of possible student replies. Explanatory text, remedial material and repeated material were incorporated into this design.

In most cases, the CAI program text that appeared on the terminal device plus the pre-recorded cassette tapes were adequate in aiding the student to master the lesson tasks. Where this was insufficient, an advisor was consulted. As problems arose, due to technical difficulties in operating a terminal device, an advisor was present to overcome these.

## 4.4  CAI PROGRAM STRUCTURE

The program is basically comprised of five major sections:

1. Entry-Behaviour Section
2. Pretest
3. CAI lesson, Part I
4. CAI lesson, Part II
5. Posttest

The conditions under which the student moved from one section to the next are illustrated in Figure 11.

One or two audio cassettes of musical examples were used in each section. Each of the cassettes are identified by section name and a sequence number. Each of the CAI lessons required two audio cassettes; one containing the principal musical examples and the other containing the remedial or review examples.

The coding of the CAI lessons and tests appears in a separate document which is available upon request.

The Entry-Behaviour section checks whether or not a student possesses the requisite knowledge for the CAI lesson on aural perception of musical styles. It is desirable that the student has a minimal knowledge in the following areas of music theory:

1. Scale construction

2. Tonality

3. Phrase structure and cadences

This section begins with introductory comments to the student that are designed to make him aware of the principles of man-machine interaction. Emphasis is placed on the fact that an advisor, lesson designer, or teacher has prepared all the material that is being presented to the student via the computer and its terminals. Following this, the general aims of the Entry-Behaviour section are outlined. The student is then given the option as to whether or not he wishes to have some information on terminal usage. A number of questions follow, dealing with scale construction. After the student answers, the correct version is usually displayed on the terminal. Based upon the student's answer,

# FIGURE 11
## FIVE MAJOR SECTIONS OF THE CAI PROGRAM
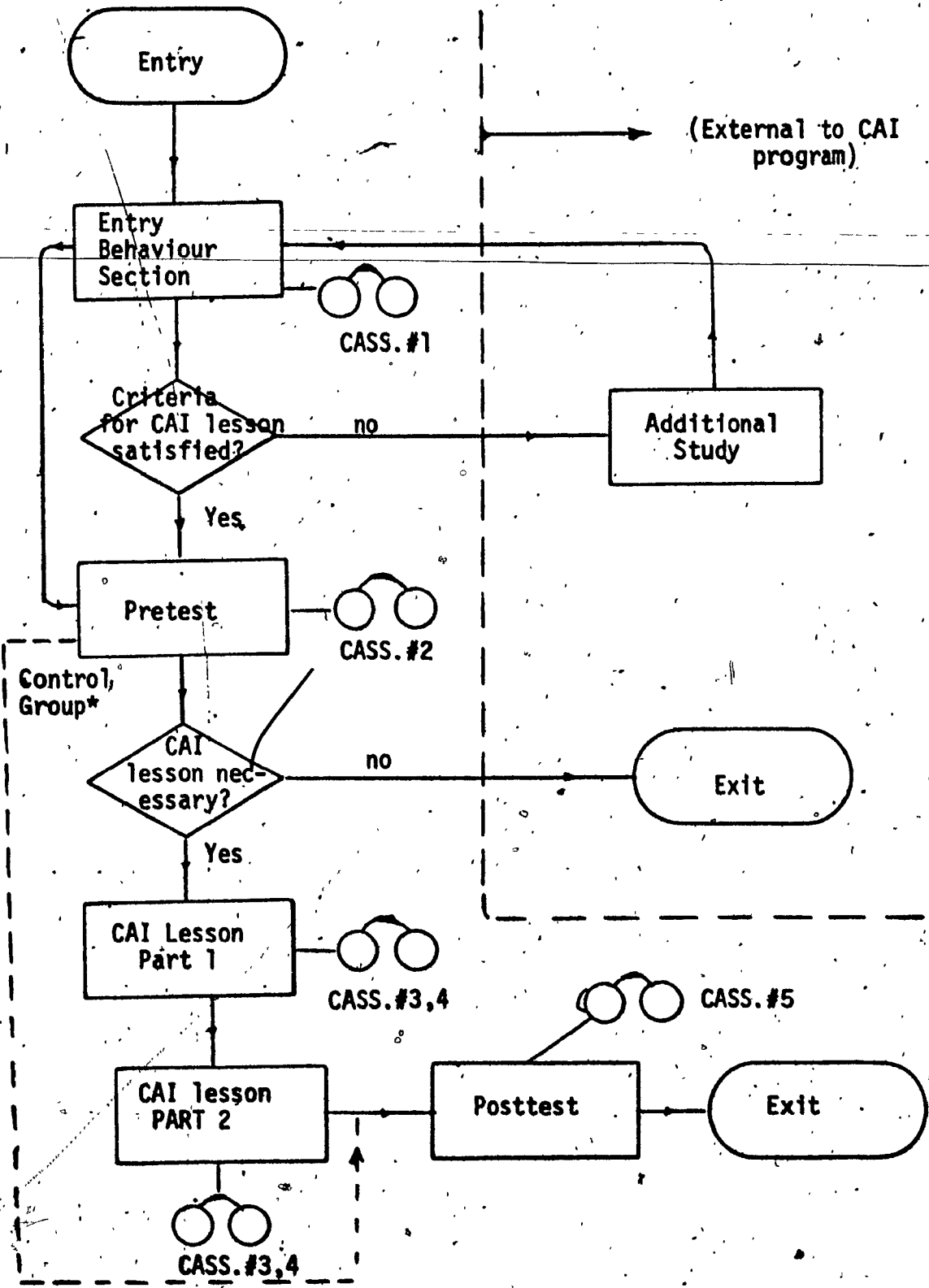


*The Control Group bypasses the CAI lessons.

he will either go on to another set of questions dealing with tonality or he will be given a number of remedial exercises of scale construction. At the stage, it must be taken into account that the student is not yet at ease in operating a terminal; typing errors are to be expected. With the questions on tonality and phrase structure, the student is instructed to listen to a number of musical examples on cassette-tape #1. Upon completion of the questions, the computer will calculate the total score and indicate to the learner whether or not he should continue on to the next section.

The pretest provides us with part of the information required to determine of any learning gain has taken place as a result of the CAI lessons. This test also indicates whether or not it is actually necessary for the student to continue on to the CAI lesson. There are 20 items in the pretest designed to test the student's knowledge and aural perception on material that is specified in the four terminal objectives (see Section 2.3).

Table IV illustrates the relationship between pretest items, enabling objectives, terminal objective and question type.

The first five questions involved the use of melodic structure, texture and dynamics as identifiable features in a musical style. Instructions were issued as to which cassette tapes to use and which examples were to be heard. Options were included in the pretest to allow the student to temporarily leave the program. This option is also to be found in various locations of the CAI lessons and the post-test.

## TABLE IV

## PRETEST ITEMS AND THEIR RELATED INSTRUCTIONAL OBJECTIVES

| QUES.# | ENABLING OBJECTIVE NO. | TERMINAL OBJ. No. | QUESTION TYPE | LEVEL OF DIFFERENCE |
|--------|------------------------|-------------------|---------------|---------------------|
| 1 | 8 | 1(3,2,4) | Describe | 10 |
| 2 | 6,8 | 2,4(1,3) | Fill in | 5 |
| 3 | 4,5,8 | 1(3,2,4) | List | 6 |
| 4 | 2 | 2(1,4,3) | Choice | 3 |
| 5 | 8 | 1(3,4,2) | Quant. | 3 |
| 6 | 3 | 3(1,4,2) | Choice | 3 |
| 7 | 4 | 3 | List | 6 |
| 8 | 6 | 2(4) | Describe | 10 |
| 9 | 9 | 3(4) | Describe | 10 |
| 10 | 6 | 2(4) | Qualif. | 8 |
| 11 | 1 | 4(3,1,2) | Spec. diff. | 6 |
| 12 | 7,2 | 2(4,1) | List | 6 |
| 13 | 10 | 4(3,2) | Choice | 4 |
| 14 | 6 | 4(1,2) | List | 6 |
| 15 | 3 | 3(1,2,4) | Quant. | 3 |
| 16 | 5 | 3(1,2,4) | Choice | 2 |
| 17 | 9,6 | 4(3) | Choice | 2 |
| 18 | 10 | 2(3,4) | Why | 9 |
| 19 | 2,10 | 4(2,1,3) | List | 6 |
| 20 | 6 | 4(2) | Describe | 10 |

Questions #11-15 dealt with the concepts of rhythmic pattern and dynamics and made use of a number of recorded examples on cassette-tape.

Questions #16-20 introduced such features as the vertical organisation of sounds. By listening to two or three musical examples, the student was able to make a comparative analysis based on the above-mentioned features. Finally, the student was given the choice as to whether to end the session or continue on to the CAI lesson.

.The CAI lesson was divided up into two parts; each part taking roughly one hour to complete. The first part presented the following introductory material:

1. The concept of style
2. General musical styles
3. 'Sub-cultural' styles.

The first three questions introduced such stylistic features as tonal relationships in music and sound quality (Meyer, 1967; Rosen, 1972). The questions generally were preceded by explanatory text plus listening examples. For example, the distinction between meter and rhythm was made by a block of explanatory text and accompanying instructions to listen to one or more relevant recorded examples. The question text was then issued. If the student's answer suggests that the material was not sufficiently understood or attended to, more simplified material would be presented with a number of recorded remedial examples. Each instructional objective was presented to the student prior to the exposition of the material. Instructions were issued to use cassette-tape #3 for the principal musical examples and cassette-tape #4 for the remedial

or review musical examples.

Questions #4 and #5 emphasised the distinction between even and uneven rhythmic patterns and its relevance to musical styles (Meyer, 1967; LaRue, 1970). Questions #6 to #10 dealt with textural changes and sound quality, stressing the interdependance between the two features (Meyer, 1967). The remaining question items lead the student into working out a comparative analysis of two musical examples.

The second part of the CAI lesson introduced other stylistic features and presented these in the same manner as in the CAI lesson, Part I. Information on the student's progress was given. In addition, the student was provided with the location of those subject areas which were of some difficulty.

Options were available where one was able to choose one of a number of content areas. After one of the content areas was completed, the student had the choice of whether to do another content area or continue to another section. The following Figure illustrates this option (see Figure 12).

At various points in the program, students were instructed to type in their impressions of the CAI lesson. A technique was incorporated whereby the student was able to type more than one line in answer to a question which required him to evaluate the lesson. A code, 'FINISH', was typed in by the student to signal the end of his multi-lined answer. This procedure occured twice in each of the two CAI lessons. The information typed in by the student was saved for future reference as part of the evaluation of the CAI program.

## FIGURE 12

## FLOW DIAGRAM OF A CONTENT-AREA OPTION
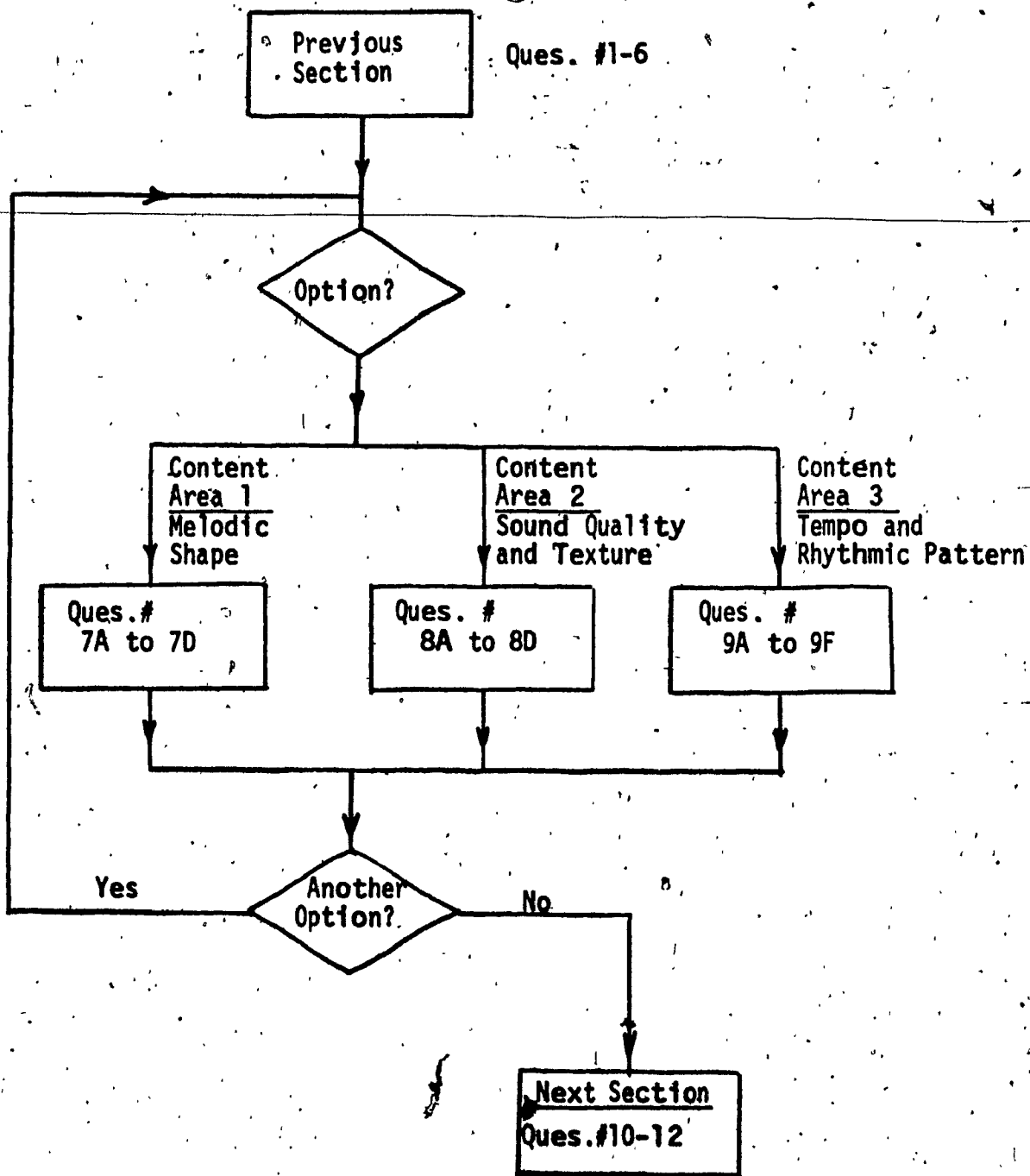
The posttest provided us with some of the information necessary to determine if any learning gain had taken place as a result of the CAI lessons. Both the pretest and posttest consist of similar measuring instruments. However, in order to control for any reactive effects due to the pretest, the following measures had to be implemented:

1. For each instructional objective, posttest items were sequenced differently than pretest items.

2. The format of the posttest questions was not exactly similar to equivalent pretest questions.

Figure 13 contains a sample pretest and posttest item. These two items are roughly equivalent in spite of their differing formats.

A list of all items in both the pretest and posttest can be seen in Appendix D.

## FIGURE 13

## EQUIVALENT PRETEST AND POSTTEST ITEMS

| PRETEST ITEM | POSTTEST ITEM |
|---|---|
| Question #3 | Question #4 |
| List 4 Features That Are Specific to a Musical Style. | A Musical Style Consists Of A Number of Characteristics Or Features.  Name 4 of These Features. |
| Question Type | Question Type |
| List | List |

# CHAPTER V
## TESTING AND EVALUATION OF THE CAI PROGRAM

### 5.1 VALIDITY AND RELIABILITY OF THE TESTS

The content validity of the tests was checked by carefully matching each item to the objectives supposedly being measured. Of prime concern was the accuracy with which each item succeeded in measuring a particular objective. Those items that did not reflect the intended objective were either modified or rejected. Skills in aural perception were appraised by the nature of the student's answer to questions that required listening to the tapes of recorded musical examples. Such items called for acts of discrimination, differentiation and identification on behalf of the student (Colwell, 1970). Instructors in the Music department of Concordia University were asked to evaluate the quality and relevance of the instructional material. Each recorded musical example was cross-checked with its related question in order to determine how appropriate that example is to the instructional objective and teaching point. Finally, a number of students in the Music department, who have already acquired much skill in aural perception, were asked to give their appraisal on the content of the CAI program. These meetings proved to be very fruitful and yielded many useful suggestions for improving the musical content.

Two methods were used in estimating the amount of reliability that exists in both pretest and posttest. The function of the first method was to determine how much internal consistency there is within a test. In order to measure this consistency, the approximate standard error (SE) was computed for each individual on those items that contribute to a particular objective. Seven students from widely varying ranges of musical experience and education were selected to carry out the pilot tests on the pretest and posttest items. The SE for each student was computed by using Lord's formula (Mehrens & Lehmann, 1973, p. 106). The standard deviation (SD) for each terminal objective and the standard errors are listed in Table V.

As a result of comparing the approximate standard error of the subjects with the standard deviation for each terminal objective, we obtained a measure of the amount of internal consistency provided by the test items (see Table VI).

## TABLE V

### RELIABILITY ESTIMATE ON PRETEST AND POSTTEST ITEMS

Terminal Objective Number

| SUBJECT | 1 Pretest SE | 1 Posttest SE | 2 Pretest SE | 2 Posttest SE | 3 Pretest SE | 3 Posttest SE | 4 Pretest SE | 4 Posttest SE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.00 | 1.34 | 1.34 | 1.00 | 1.22 | 1.00 | 0.00 |
| 2 | 1.00 | 1.00 | 1.26 | 1.26 | 1.22 | 1.22 | 1.26 | 1.26 |
| 3 | 1.00 | 1.00 | 1.26 | 1.34 | 1.00 | 1.22 | 1.26 | 1.00 |
| 4 | 1.00 | 1.00 | 1.00 | 1.26 | 1.22 | 1.22 | 1.26 | 1.26 |
| 5 | 1.00 | 1.00 | 0.00 | 1.26 | 1.00 | 1.00 | 1.26 | 1.34 |
| 6 | 1.00 | 1.00 | 1.26 | 1.26 | 1.22 | 1.22 | 1.26 | 1.34 |
| 7 | 1.00 | 0.00 | 1.34 | 1.26 | 1.22 | 1.22 | 1.00 | 1.26 |
| SD | 0.73 | 0.68 | 1.32 | 0.80 | 0.78 | 1.06 | 1.00 | 1.38 |

## Table VI

## DEGREE OF INTERNAL CONSISTENCY - PRETEST AND POSTTEST ITEMS

| NO. OF STANDARD DEVIATIONS | Terminal Objective Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| | Pretest Items | Posttest Items | Pretest Items | Posttest Items | Pretest Items | Posttest Items | Pretest Items | Posttest Items |
| ±1 SD | 14.3* | 14.3 | 71.4 | 0.0 | 0.0 | 14.3 | 28.6 | 100.0 |
| ±2 SD | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Normal Distribution

±1 SD   68%

±2 SD   95%

*All figures represent the number of subjects as a percentage of the total.

When one compares the number of subjects that fall within two SD's with the number that would occur in a normal distribution (95%), one finds a high degree of internal consistency. There was some lack of internal consistency when one compared the number of subjects falling within one SD with number that would occur in a normal distribution (68%). Only those items of the pretest contributing to terminal objective #2 (71.4%) came close to the normal distribution. Hence, all other items were modified and subsequent trials demonstrated that the revised items improved the internal consistency of the tests (see Tables VII, VIII).

Another measure was made to determine the degree of external reliability of the tests. The degree of correlation between the pretest and posttest was computed (Mehrens & Lehmann, 1973, p. 112). On the original tests, a value of 0.799 was obtained. After the tests were revised, a value of 0.831 was computed for the degree of correlation, indicating that 68% of the variance of one test can be attributed to the other test. This is widely considered to be a good measure of the external reliability of the pretest and posttest (Ferguson, 1971).

It was also found that, for each test, a high degree of internal reliability existed (see p. 65 ; Tables VII, VIII). Thus, taken together both measures of reliability give us a reasonable amount of confidence that the tests provide a consistent measuring instrument for students whose capabilities vary considerably.

After having examined both the validity and reliability of the tests, we expect that the final set of pretest and posttest items will adequately measure the extent to which the students achieve any one of the instructional objectives.

# TABLE VII

## RELIABILITY ESTIMATE ON PRETEST AND POSTTEST ITEMS (REVISED TEST)

| SUBJECT | Terminal Objective Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| | Pretest SE | Posttest SE | Pretest SE | Posttest SE | Pretest SE | Posttest SE | Pretest SE | Posttest SE |
| 1 | 1.00 | 1.00 | 1.26 | 1.34 | 1.00 | 1.00 | 1.26 | 1.26 |
| 2 | 0.00 | 0.00 | 1.34 | 1.00 | 1.22 | 1.22 | 1.00 | 1.34 |
| 3 | 1.00 | 0.00 | 1.26 | 1.26 | 0.00 | 1.00 | 0.00 | 1.26 |
| 4 | 0.00 | 0.00 | 0.00 | 1.26 | 1.22 | 1.22 | 1.34 | 1.34 |
| 5 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| 6 | 1.00 | 1.00 | 1.34 | 1.26 | 1.22 | 1.22 | 1.34 | 1.00 |
| 7 | 0.00 | 0.00 | 1.26 | 1.26 | 1.22 | 1.22 | 1.00 | 1.34 |
| SD | 0.857 | 1.00 | 1.32 | 1.29 | 1.13 | 1.11 | 1.13 | 1.16 |

## Table VIII

## DEGREE OF INTERNAL CONSISTENCY - PRETEST AND POSTTEST ITEMS (Revised Test)

| NO. OF STANDARD DEVIATIONS | Terminal Objective Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| | Pretest Items | Posttest Items | Pretest Items | Posttest Items | Pretest Items | Posttest Items | Pretest Items | Posttest Items |
| ± 1 SD | 42.8 | 57.1 | 71.4 | 85.7 | 42.8 | 42.8 | 57.1 | 28.5 |
| ± 2 SD | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

## 5.2 RESULTS OF THE FORMATIVE EVALUATION

A formative evaluation of this CAI program was considered to be of utmost importance as there are few, if any, existing programs which attempt a dialogue form of communication in the learning of concepts dealing with musical style. One obvious difficulty with this type of program is the inability to handle every possible type of response to a question. Student reactions to this program in the form of feedback to the designer of the program had to be collected and examined.

Thus, a formative evaluation of the CAI program was conducted as a result of comments and suggestions made by those students who were engaged in the pilot tests. Students noted their comments both during and after their sessions at the terminals.

Some of these remarks follow:

"Explain deceptive cadence."

"Did you want the name or number of the cadence."

"The CAI lesson was very informative."

"Don't know which 'o' to use on the terminal for the letter 'o' (not number 'zero')."

"Should there be so many musical examples?"

"(I) Like the idea of getting immediate feedback."

"Some explanation should be included with this type of question."

"Good variety of questions."

"Found the musical examples both stimulating and enjoyable."

The students' comments and suggestions, as noted on the teletype printouts, were analysed and summarized. Student reactions to the CAI program that were particularly positive may be summed up as follows:

1. Program reactions to the answers were perceived by the students to be beneficial and motivating. The CAI program usually took into account the nature of the student's answer regardless of whether it was correct or not.

2. The variety of question types was a definite factor in maintaining student interest.

3. The immediate availability of musical examples was noted. In particular, it was found useful to be able to listen repeatedly to a musical example as a means of verifying one's initial aural experience.

4. Students were able to make use of the CAI program on any weekday they chose.

5. Students were free to leave the CAI program at any time.

6. The immediate feedback on the terminal to the individual's answer was found to be very desirable.

7. The quality and length of the recorded musical excerpts were positively noted.

A number of negative comments were also noted:

1. In some cases, it was found that the exposition of a question, as generated by the CAI program, was inadequate and required further explanation.

2. Some operational difficulties with regard to the terminal were encountered.

3. In some cases, students had trouble in operating the cassette recorder. In particular, it was found that it took a considerable amount of time to backspace or 'fast-forward' the tape to the desired location.

4. The computer-generated answer and accompanying explanation was, in some cases, felt to be incomplete.

5. It was felt that the pretest was too long.

6. Students prefer some feedback in the pretest section.

7. An option should be included whereby the student may bypass the Entry-Behaviour section of the CAI program.

8. It was thought that one should have more opportunities to temporarily leave the CAI program.

9. It was felt that more student-controlled strategies could be included within the framework of a CAI lesson.

In general, the students found such factors as question variety, immediacy of response, and free, unlimited access of instructional facilities to be very effective in achieving the specified musical objectives. Most of the complaints centered on the use of the equipment (i.e. - typing answers on the keyboard of the terminal). Some measures were taken to prepare students on terminal usage. These are discussed in Section 5.3.

The great majority of those students who interacted with the CAI program felt that the experience was enjoyable, instructive and

stimulating.

## 5.3 CONSIDERED AND IMPLEMENTED CHANGES

In order to overcome some of the difficulties encountered in operating a computer terminal, a 'Terminal Usage' form was designed (see Appendix E). This form contained explicit instructions on how to communicate with the computer time-sharing system and gain access to the CAI program. Included in the form was a set of guidelines on the proper usage of the typewriter keyboard. The 'Terminal Usage' form was presented to the student prior to his session at the terminal.

In the Entry-Behaviour section and both CAI lesson sections, more control was given to the student. Options were added to allow students the opportunity to choose the subject material and to repeat exercises. Options to exist temporarily from the CAI program were also included.

Where inadequacies in the question text were noted, revisions were made and modified. Question texts were subsequently entered into the CAI program. A similar procedure was used in the case of inadequate explanations of answers.

## 5.4 COSTS

No budget was necessary since the CAI program was not funded. Most of the costs were defrayed in the following manner --

1. Personal costs - borne by author.
2. Material costs - computer facilities were available at no charge
   - cassette-tapes and recorders were made available

from CIT.

- All forms and instruction sheets were designed and multiprocessed at the author's expense.

The following tables contain the relevant costs incurred in the development and implementation of the CAI program. (Tables IX and X ).

The cost per student in using the terminal was broken down according to the various modules of the CAI program, (see Table X1).

It should be noted that the costs, indicated in Table X1, include both the use of the Central Processing Unit (CPU) and the Peripheral or Input/Output Units.

The average time that was taken on the terminal is noted for each section of the CAI program in Table XII.

Thus, in terms of the actual length of time that a student spends at the terminal an average cost of $2.40/hour is incurred. This figure compares favourably with other CAI programs (Holtzman, 1970), if one takes into account that the overall time estimate includes the time spent by the student in listening to the recorded examples on the cassette-recorder.

## TABLE IX

### CAI DEVELOPMENT COSTS

| ITEM | COST |
|------|------|
| Program planning - personal labour, 80 hrs. | $ 400 |
| Codification of CAI program, 140 hrs. | 700 |
| Testing of CAI program, 40 hrs. | 200 |
| Terminal usage, CPU = 120 sec. | 50 |
| Preparation of aural materials - | |
|     5 cassette tapes (20 hrs.) | 100 |
|     2 master tapes (8 hrs,) | 40 |
| Design of instructional sheets | |
|     COTP forms and evaluation forms, 10 hrs. | 50 |
| Multiprocessing of forms, 3 hrs. (200 copies) | 25 |
| | TOTAL:- $1,565 |

## TABLE X
### CAI IMPLEMENTATION COSTS

| ITEM | COST |
|------|------|
| Terminal usage, CPU = 20 sec. per student (expt. group) | |
| CPU = 300 sec. for 15 students | $ 160 |
| CPU = 10 sec (control group) | |
| CPU = 150 sec. for 15 students | 80 |
| CPU = 45 sec. excess time | 25 |
| TOTAL:- | $ 265 |

## TABLE XI
## CAI COSTS PER STUDENT

| MODULE | COST |
|---|---|
| Entry-Behaviour Section | $ 1.30 |
| Pretest Section | 2.00 |
| CAI Lesson I | 2.60 |
| CAI Lesson II | 2.60 |
| Posttest Section | 2.00 |
| TOTAL:- | $ 10.20 |

## TABLE XII
## COMPUTER TERMINAL TIME ESTIMATES

| SECTION | REAL TIME (hrs - min) | CPU[1] Time (sec) |
|---|---|---|
| Entry Behaviour | 0 - 30 | 2.20 |
| Pretest | 0 - 45 | 3.45 |
| CAI Lesson, Part I | 1 - 20 | 5.20 |
| CAI Lesson, Part II | 1 - 00 | 4.90 |
| Posttest | 0 - 40 | 3.15 |
| TOTAL:- | 4 - 15 | 18.90 |

[1]Central Processing Unit time or actual computing time.

## 5.5 TIME SCHEDULE

A time schedule was prepared in order to forecast the completion date for each phase of the porject. In order to obtain a reasonable estimate of the time periods, a number of fixed time factors had to be taken into account. The following factors were considered:

1. Student volunteers would be available only between October and March.

2. Peak study periods (i.e. December, March) would have to be avoided.

The time schedule was periodically revised as each phase of the project was realized. The final schedule appears as follows:

| | STARTING DATE | CLOSING DATE |
|---|---|---|
| Program Documentation | 1 Nov. 1973 | 25 Dec. 1973 |
| Specification of teaching points, Strategies and program steps | 4 Dec. 1973 | 4 Mar. 1974 |
| Construction of the CAI program | 10 Mar. 1974 | 10 June 1974 |
| Transmission of the CAI program into computer memory via the terminal | 15 May 1974 | 20 July 1974 |
| Error checking procedures | 4 July 1974 | 20 July 1974 |
| Pilot tests | 4 Aug. 1974 | 31 Aug. 1974 |
| Modification of the CAI program | 4 Sept. 1974 | 10 Oct. 1974 |
| Implementation of the CAI program | 15 Oct. 1974 | 8 Mar. 1975 |
| Writing of final document | 10 July 1974 | 13 Mar. 1975 |
| Revisions to document | 15 Apr. 1975 | 31 July 1975 |
| Typing | 1 Aug. 1975 | 15 Aug. 1975 |

# CHAPTER VI
## PROCEDURES

After having established a time schedule for implementing the CAI program on an experimental basis, it was necessary to establish those procedures through which the experiment would be conducted. The variables that occur within the experiment had to be defined and a method for extracting the student sample would have to be devised.

## 6.1 THE VARIABLES

### INDEPENDENT VARIABLE:

1. Experimental treatment
   - CAI lesson, part I
   - CAI lesson, part II

2. No experimental treatment
   (Nominal data)

### MODERATOR VARIABLE #1:

Undergraduate level of musical achievement.

1. 1st year in the Music Program and a maximum of one year of practical musicianship.

2. 1st year in the Music Program and two to three years of practical musicianship.

3. 2nd year in the Music Program and a maximum of one year of practical musicanship.

3. 2nd year in the Music Program and two to three years of practical musicianship.

3rd year in the Music Program and a maximum of one year of practical musicianship.

4. 3rd year in the Music Program and two or more years of practical musicanship.

(Ordinal data).

## MODERATOR VARIABLE #2

Previous scholastic grades in music:

1. Grade F
2. Grade D
3. Grade C
4. Grade B
5. Grade A

## MODERATOR VARIABLE #3

Prior exposure to aural perception:

1. Aural perception course not taken
2. Aural perception course taken.

## MODERATOR VARIABLE #4

Prior usage of computer terminals

1. No prior usage
2. Prior usage.

CONTROL VARIABLE #1

Undergraduate level students only.

CONTROL VARIABLE #2

Knowledge of the basic essentials of music theory.  This variable is controlled by the Entry-Behaviour section of the CAI program.

CONTROL VARIABLE #3

The student does not already have full mastery of musical style. This variable is controlled by the Pretest section of the CAI program.

DEPENDANT VARIABLE

Posttest scores.

INTERVENING VARIABLES

1.  Intrinsic interest in the study of musical styles.

2.  Attitude towards CAI.

3.  Anxiety level of students at a computer terminal.

## 6.2  POPULATION AND SAMPLE

The population was considered to be all music students at the university level in Montreal.  Our sample was extracted from 530 undergraduate students at the Sir George Williams Campus of Concordia University who are taking at least one course in music.  Students in the first, second or third year of a degree program were considered as possible candidates for the experimental or control group.  Each student that agreed

to undergo the CAI experimental program did so on a volunteer basis. There was no requirement involved in taking the CAI lessons; nor were students given an honorarium for their time and effort. A total of 20 students turned up for the experiment. Out of this sample, 10 made up the experimental group and 10 were in the control group. Allocation to each group was made on a 'first-come-first-served' basis.

A toss of a coin was made to decide whether the first volunteer would go into the experimental or control group. Thereafter, each new arrival was placed in alternate order (see Figure 14).

Each student entered in the CAI program with his own set of skills, information and attitudes. By the time the student took the CAI lessons, it was presumed that he had a rudimentary knowledge of the theoretical principles of music. In other words, he was acquainted with scale systems, intervals, time signatures, tonality and harmony. He had some abilities in aural perception and was able to estimate pitch differences. The function of the Entry Behaviour and Pretest section was, among others, to insure that students had a minimal level of musical knowledge before embarking on the CAI lessons.

Randomization of the sample from the population was not possible because of the following reasons:

1. Classroom schedules could not be adjusted to allow for a CAI program based on random selection.

2. It was felt that the mortality rate under a randomized selection scheme would be excessively high.

# FIGURE 14
## ORDER OF ASSIGNMENT

**SUBJECT NUMBER**



Control Group

Toss of coin

Experimental Group

1
2
3
4
5
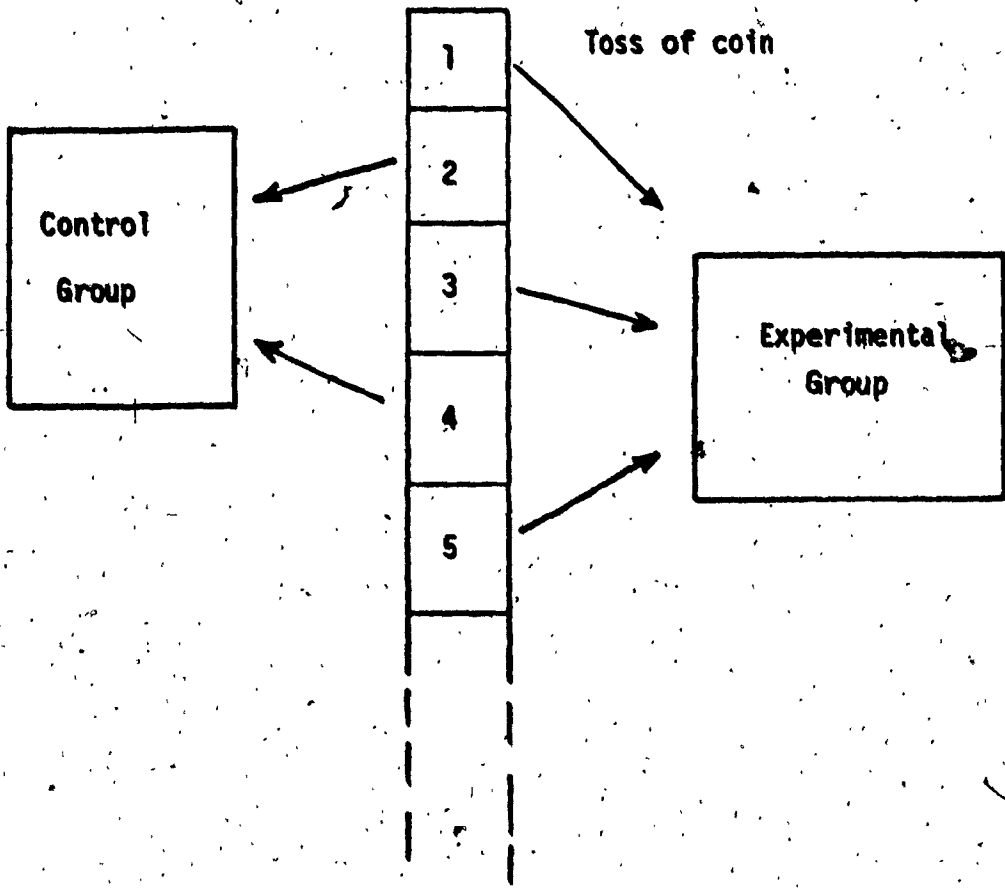
## 6.3 DESIGN TYPE AND PROCEDURE

Since the purpose of our experiment was to determine whether or not a significant gain in learning took place as a result of the CAI program, it was decided to choose the 'non-equivalent control group design' (Stanley and Campbell, 1963) as our design model.

$$\frac{0_1 - X_1 - 0_2}{0_3 - X_2 - 0_4}$$

$X_1$ - Treatment
   (Pretest-CAI lessons-Posttest)

$X_2$ - No Treatment
   (Pretest-Posttest)

$0_1$ and $0_2$ represent the pretest scores and posttest scores respectively in the treatment case. $0_3$ and $0_4$ refer to Pretest and Posttest scores respectively, where no treatment is given.

In order to demonstrate that the main effects of history, maturation and testing were controlled, it had to be shown that:

1. $0_1 \approx 0_3$ and

2. $0_2 - 0_1 > 0_4 - 0_3$

The results (see Section 6.6) clearly indicate that the difference, $0_2 - 0_1$, was due to the treatment and not to any of the main effects of history, maturation and testing. For the purposes of computation, the means and the variances were used in testing for significant differences.

Selection bias could not be controlled as the sample was not a randomized one, and students entered into the experiment on a volunteer basis. There was no strict control for a Hawthorn effect.

Mortality was very low since those students who engaged in the CAI program, did so on a volunteer basis and tended to complete the program.

At the commencement of the Fall term, 1974, CAI advertisement notices were posted at suitable locations, in both the Music building on Bishop St. and the Hall Building. Students were informed as to the nature of the program and its location. As each student arrived, he was asked to fill out the Registration Sheet (see Table XIII).

Prior to using the terminal, the student was asked to read the Terminal Usage Instruction Sheet (see Appendix D) and familiarize himself with the terminal commands. He was then assigned to either the experimental or control group in accordance with the procedure as outlined in Section 6.2. Students were free to take as much time as they wished for each session at the terminal. In addition, they were able to come for as many sessions as they needed in order to complete the CAI program. In the majority of cases, students took three sessions, at one hour per session, at the terminal. The sessions, in most cases, were structured as follows:

1. Session 1: Entry Behaviour Section and Pretest

2. Session 2: CAI Lesson I

3. Session 3: CAI Lesson II and Posttest

Those students who made up the control group generally required only one session during which both the pretest and posttest were presented.

An advisor was present during these sessions in order to insure that students operate the terminals as smoothly as possible. The advisor would intervene only in those cases where students had problems in communicating with the CAI program. This might occur through the use of improper commands or misspelled commands. Under no circumstances would the advisor aid the student in replying to questions displayed on the

## Table XIII

## CAI REGISTRATION SHEET

| Date | Time | Name of Student | Year in Program | Took Aural Perception ? | Operated Computer Terminal ? | Last Year's Marks |
|------|------|-----------------|-----------------|-------------------------|------------------------------|-------------------|
|      |      |                 |                 |                         |                              |                   |

terminal nor would he provide any information related to the subject content of the program. At the end of a section (ie. pretest), the student was informed, via the terminal, as to the nature of the next section and the approximate time it would take to complete the section. An account of the student's interaction with the CAI program was saved, providing one with the most complete record that one could expect. A sample of this type of interaction can be seen in Appendix F. Where the screen-type terminal was used, the scores only were noted. This data was available for immediate or later analysis and thus served as a base for diagnosing difficulties with the teaching strategy. A summative-type evaluation of the CAI program (see Section 6.6) would then make use of the diagnosis. Upon completion of the pretest and posttest, the scores were noted and transferred onto the Scoresheet.

At the end of the last session, the student was given an Evaluation form assessing his overall impression of the CAI program. The following factors were included among the questions in the form:

1. Level of difficulty of content
2. Relevance of instructional material
3. Degree of student-control
4. Anxiety level
5. Intrinsic interest in the subject matter
6. Attitude towards CAI in general
7. Suggestions for improvement.

The evaluation form is included in Appendix G.

## 6.4 . DATA AND INSTRUMENTATION

As each student did the pretest and posttest, the scores were compiled in the form of raw data and stored in computer memory. This operation occured directly from the student's answer on the terminal. Section 5 has shown that the measures used possessed the necessary validity and reliability. Since the pretest and posttest items were equivalent in subject content, the parallel-forms reliability test was used.

At the end of a test, the total score would be computed by the CAI program and displayed on the terminal. The total scores for each student in both the experimental and control cases appear in Table XIV.

The scores on those items that contributed towards objectives number one, two and three were totalled. The tabulation of these total scores appear in Table XV.

The scores on those items that contributed towards objectives number one, two and four were totalled. The tabulation of these total scores appear in Table XVI.

## TABLE XIV

## TEST SCORES FOR CAI PROGRAM

| EXPERIMENTAL GROUP | | | CONTROL GROUP | | |
|---|---|---|---|---|---|
| Pretest | Posttest | % Gain[1] | Pretest | Posttest | % Gain |
| 6 | 11 | 35.7 | 4 | 6 | 12.5 |
| 3 | 13 | 58.8 | 3 | 5 | 11.8 |
| 5 | 13 | 53.3 | 6 | 7 | 7.1 |
| 5 | 15 | 66.6 | 3 | 3 | 0.0 |
| 5 | 12 | 46.6 | 5 | 4 | -6.7 |
| 3 | 12 | 52.9 | 4 | 5 | 6.3 |
| 4 | 11 | 43.8 | 5 | 5 | 0.0 |
| 4 | 12 | 50.0 | 3 | 4 | 5.9 |
| 5 | 14 | 60.0 | 5 | 6 | 6.7 |
| 3 | 11 | 47.0 | 4 | 4 | 0.0 |

[1]% Gain was computed using the following formula:

$$\% \text{ Gain} = \frac{\text{Posttest} - \text{Pretest}}{20 - \text{Pretest}} \times 100$$

## Table XV

## PRETEST AND POSTTEST SCORES FROM ITEMS
## BASED ON OBJECTIVES #1, 2, 3

| EXPERIMENTAL GROUP | | CONTROL GROUP | |
|---|---|---|---|
| Pretest | Posttest | Pretest | Posttest |
| 4 | 10 | 3 | 5 |
| 2 | 11 | 2 | 5 |
| 5 | 12 | 4 | 6 |
| 4 | 10 | 3 | 3 |
| 4 | 10 | 2 | 4 |
| 3 | 9 | 4 | 5 |
| 3 | 10 | 4 | 5 |
| 2 | 9 | 2 | 4 |
| 4 | 10 | 4 | 6 |
| 3 | 7 | 3 | 3 |

## TABLE XVI

## PRETEST AND POSTTEST SCORES FOR ITEMS BASED ON OBJECTIVES #1, 2 AND 4

| EXPERIMENTAL GROUP | | CONTROL GROUP | |
|---|---|---|---|
| Pretest | Posttest | Pretest | Posttest |
| 5 | 7 | 2 | 3 |
| 2 | 9 | 3 | 4 |
| 3 | 9 | 6 | 5 |
| 3 | 12 | 3 | 3 |
| 3 | 9 | 4 | 3 |
| 2 | 11 | 2 | 2 |
| 2 | 6 | 4 | 3 |
| 3 | 8 | 2 | 3 |
| 3 | 11 | 3 | 4 |
| 2 | 9 | 3 | 3 |

The information on the student registration sheets (see Section 6.2) was converted into numeric type data as follows:

1. Year in Program -  1 = 1st year in program

                                    2 = 2nd year in program

                                    3 = 3rd year in program

2. Last year's marks -  1 = Grade F

                                    2 = Grade D

                                    3 = Grade C

                                    4 = Grade B

                                    5 = Grade A

3. Took Aural Perception course?

                                    1 = No

                                    2 = Yes

4. Used Computer Terminals before?

                                    1 = No

                                    2 = Yes

The data was tabulated for the Experimental Group and the Control Group.

In the experimental group, eight students took an Aural Perception course and two never had Aural Perception. In the control group, however, half of the students took an Aural Perception course.

In both the experimental and control groups, only 20% of the students had some prior experience with computer terminals.

# CHAPTER VII
## SUMMATIVE EVALUATION AND RESULTS OF THE CAI PROGRAM

## 7.1 ANALYSIS AND RESULTS

Upon examination of the pretest scores for both the experimental and control groups (see Table XIII) we find a remarkable similarity in the means. The experimental group mean was 4.3 whereas that for the control group was 4.2. Both groups also have almost identical variances in their pretest scores.

The t-test underscores the fact that at the .05 level, no significant differences exist between the control group and experimental groups as measured by the pretest (df = 18; t = 0.214).

The posttest mean for the experimental group was 12.4 whereas that for the control group was 4.9. The difference between posttest and pretest means for the experimental group was 8.1 whereas the difference for the control group was 0.7. Thus, the relationship $O_2-O_1 > O_4-O_3$ holds true (see Section 6.2 for an explanation of the symbols $O_1$, $O_2$, $O_3$ and $O_4$).

A significant difference (p < .05) exists between the mean scores of the posttest for the control group and the experimental group (df = 18, t = 13.2). The design that has been used clearly controls several potential dangers to internal validity such as history, maturation and testing.

The means, variances and standard deviations of the pretest and posttest scores were computed. The results appear in Table XVII.

As the time difference between the pretest and posttest was quite short (ie. one to two weeks), several problems were introduced into the analysis; the effects of regression, the memorization of pretest items and the familiarization with the pretest format. It was therefore decided that the main analysis would be based on the posttest given at the end of the CAI lessons. Some control over individual difference would be attained by using the pretest scores as a control variable in an analysis of covariance procedure. In other words, the pretest effects were neutralized. The pretest scores were entered as a covariate in the analysis of covariance.

The analysis of covariance results for the main hypothesis are presented in Table XVIII.

The type of analysis of covariance used was able to take into account the unequal cell frequencies that occurred in our experiment (Winer, 1971). The F value for treatment type on the posttest scores was 44.84. The tabled F at the .05 level was 4.67 (df = 1/13). Therefore, the null hypothesis that there are no significant differences between the experimental and control groups with respect to student achievement due to the CAI program is rejected. In addition, it was demonstrated that the academic level of the student had no significant bearing on his learning achievement due to the CAI lessons (F = 1.133, df = 2/13; non-significant at the .05 level).

## TABLE XVII

## MEANS, VARIANCES AND STANDARD DEVIATIONS OF THE SCORES

|  |  | Experimental Group | Control Group |
|---|---|---|---|
| **PRETEST:** |  |  |  |
|  | Mean | 4.3 | 4.2 |
|  | Variance | 1.122 | 1.067 |
|  | SD | 1.059 | 1.033 |
| **POSTTEST:** |  |  |  |
|  | Mean | 12.4 | 4.9 |
|  | Variance | 1.822 | 1.433 |
|  | SD | 1.350 | 1.197 |
| **% GAIN:** |  |  |  |
|  | Mean | 51.47 | 4.36 |
|  | Variance | 79.353 | 35.565 |
|  | SD | 8.908 | 5.964 |

## TABLE XVIII
## ANALYSIS OF COVARIANCE; POSTTEST SCORES

| SOURCE | DEGREES OF FREEDOM | MEAN SQUARE | F |
|---|---|---|---|
| COVARIATE | | | |
| Pretest Scores Between: | | | |
| Treatment type | 1 | 238.84 | 44.84* |
| Academic Level | 2 | 6.035 | 1.133 |
| Treatment-Academic Level | 2 | 1.74 | 0.328 |
| Error | 13 | 5.326 | |

* Significant (p < .05)

A rank-order correlation was computed between the percent gain obtained as a result of the CAI lessons and the average marks from last year's courses. The coefficient of correlation obtained was +0.21; this value being nonsignificant. Therefore, the secondary hypothesis that there is a significant relationship between the student's previous marks and his percent gain due to the CAI lessons is rejected.

A five-factor analysis of variance was made on the data in order to determine whether the treatment had a sifnificant effect on the posttest scores where all five factors were taken into account. In addition to the Treatment Type (Experimental vs. Control) the other factors considered were as follows:

Academic Level        -    Levels:  1, 2 and 3
Grade                 -    Levels:  3, 4 and 5
Aural Perception      - -  Levels:  1 and 2
Terminal Usage        -    Levels:  1 and 2

The results of this analysis of variance appears in Table XIX.

Taking all the moderating factors into account, Table 19 indicates that the treatment had a significant effect on the posttest scores.

There was no significant effect on the posttest scores by such moderating factors as prior experience in aural perception. In other words, those students that already took an aural perception course did not perform significantly better than those students who had no prior exposure to the course.

It was also found that prior operational experience with computer terminals did not significantly affect the posttest scores (see Table XIX).

## TABLE XIX

## FIVE-FACTOR ANALYSIS OF VARIANCE, POSTTEST SCORES

| SOURCE | DEGREES OF FREEDOM | MEAN SQUARE | F |
|---|---|---|---|
| Treatment | 1 | 923.04 | 923.0400* |
| Academic Level | 2 | .52113 | .5210 |
| Grade | 2 | 5.63380 | .0560 |
| Aural Perception | 1 | 1.4085 | 1.4085 |
| Terminal Usage | 1 | 1.4085 | 1.4085 |
| Treat Acad | 2 | .18310 | .1831 |
| Treat Grade | 2 | .22535 | .2254 |
| Treat Aural | 1 | .90141 | .9014 |
| Treat Term | 1 | .90141 | .9014 |
| Acad Grade | 4 | .39437 | .3944 |
| Acad Aural | 2 | .18310 | .1831 |
| Acad Term | 2 | .43662 | .4366 |
| Grade Aural | 2 | 1.7465 | 1.7465 |
| Grade Term | 2 | 1.0704 | 1.0704 |
| Aural Term | 1 | 2.7606 | 2.7606 |
| Treat Acad Grade | 4 | .18310 | .1831 |
| Treat Acad Aural | 2 | .69014 | .6901 |
| Treat Acad Term | 2 | 1.2817 | 1.2817 |
| Treat Grade Aural | 2 | 1.7465 | 1.7465 |
| Treat Grade Term | 2 | 1.7465 | 1.7465 |
| Treat Aural Term | 1 | .0000 | .0000 |
| Acad Grade Aural | 4 | .39437 | .3944 |
| Acad Grade Term | 4 | 1.6197 | 1.6197 |
| Acad Aural Term | 2 | .94366 | .9437 |
| Grade Aural Term | 2 | .22535 | .2254 |
| Treat Acad Grade Aural | 4 | .26761 | .2676 |
| Treat Acad Grade Term | 4 | 1.2394 | 1.2394 |
| Treat Acad Aural Term | 2 | 2.0704 | 2.0704 |
| Treat Grade Aural Term | 2 | 3.5493 | 3.5493 |
| Acad Grade Aural Term | 4 | .69014 | .6901 |
| Treat Acad Grade Aural Term | 4 | 2.1972 | 2.1972 |
| Error | 2 | 1.0000 | |

* Significant (p < .05)

The interactive effects between the treatment type and terminal experience was not significant (see Table XIX). Thus the students in the control group who had terminal experience scored no higher on the average in the posttest than those who had no terminal experience. This would support the prior conclusion the experience with computer terminals des not give the student any significant advantage with respect to his performance on the CAI lessons.

A two-factor analysis of variance was made on the data in order to determine whether the treatment had a significant effect on the posttest scores. This analysis was divided up into two sections. The first section examined treatment effects on posttest scores for items based on instructional objectives 1, 2 and 3 (see Table XX). The second section dealt with a similar examination based, however, on instructional objectives 1, 2 and 4 (see Table XXI).

In both cases, the treatment had a significant effect on the posttest scores (F = 87.5417; df = 2/14; F = 88.2298, df = 2/14).

Table XXII lists the posttest scores achieved by each student on those items that contribute to a particular objective. According to the criteria established before the test, two out of three items for objective #1, five out out of six items for objective #2, three out of five items for objective #3 and four out of six items for objective #4 had to be answered satisfactorily. As a result of these criteria, the last line of the table indicates the average percent achievement on each objective by students in the experimental group and the control group.

## Table XX

## ANALYSIS OF VARIANCE; INSTRUCTIONAL OBJECTIVES 1, 2 AND 3

| SOURCE | DEGREES OF FREEDOM | MEAN SQUARE | F |
|---|---|---|---|
| Between: | | | |
| Treatment | 1 | 134.960 | 87.5417* |
| Academic Level | 2 | 0.786 | 0.5100 |
| Treatment-Academic level | 2 | 1.743- | 1.1304 |
| Within: | 14 | 1.542 | |

* Significant (p < .05)

## Table XXI

## ANALYSIS OF VARIANCE, INSTRUCTIONAL OBJECTIVES 1, 2 AND 4

| SOURCE | DEGREES OF FREEDOM | MEAN SQUARE | F |
|---|---|---|---|
| Between: | | | |
| Treatment | 1 | 164.380 | 88.2298* |
| Academic level | 2 | 3.598 | 1.9311 |
| Treatment - Academic Level | 2 | 1.902 | 1.0210 |
| Within: | 14 | 1.863 | |

* Significant $(p < .05)$

## TABLE XXII

## POSTTEST SCORES ON A PER OBJECTIVE BASIS

| | Experimental Group | | | | Control Group | | | |
| | Posttest Score-Items on Objective | | | | Posttest Score-Items on Objectives | | | |
| Student | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| 1 | 2/3* | 4/6 | 4/5 | 1/6 | 1/3 | 1/6 | 3/5 | 1/6 |
| 2 | 2/3 | 5/6 | 4/5 | 2/6 | 2/3 | 2/6 | 1/5 | 0/6 |
| 3 | 3/3 | 5/6 | 4/5 | 1/6 | 2/3 | 2/6 | 2/5 | 1/6 |
| 4 | 2/3 | 5/6 | 3/5 | 5/6 | 1/3 | 2/6 | 0/5 | 0/6 |
| 5 | 3/3 | 4/6 | 3/5 | 2/6 | 2/3 | 1/6 | 1/5 | 0/6 |
| 6 | 3/3 | 5/6 | 1/5 | 5/6 | 0/3 | 2/6 | 3/5 | 0/6 |
| 7 | 2/3 | 3/6 | 5/5 | 1/6 | 1/3 | 2/6 | 2/5 | 0/6 |
| 8 | 1/3 | 4/6 | 4/5 | 3/6 | 1/3 | 2/6 | 1/5 | 0/6 |
| 9 | 3/3 | 4/6 | 3/5 | 4/6 | 1/2 | 3/6 | 2/5 | 0/6 |
| 10 | 1/3 | 4/6 | 2/5 | 4/6 | 1/3 | 1/6 | 1/5 | 1/6 |
| % Achievement | 80 | 90 | 80 | 30 | 30 | 0 | 20 | 0 |

*2/3 indicates that 2 out of 3 items were correct

From Table XXII, it can be seen that 30% of the students in the Control Group achieved Objective #1 and 20% achieved Objective #2. No students in the control group were able to achieve objectives #3 or 4. At least 80% of the students in the Experimental Group achieved the first three objectives. Interestingly enough, only 30% in the Experimental Group were able to achieve the last objective. The low percentage for achievement of objective #4 could have been due to the following factors:

1. Those test items for Objective #4 occured at the tail end of the quiz. Hence, fatigue would have been a definite factor in this case.

2. A number of students felt that the posttest was too long.

3. There were, on the average, a greater number of recorded examples per item on those items related to objective #4 than for any other objective.

## 7.2 SUMMATIVE EVALUATION

Upon the conclusion of the experiment, all student evaluation forms (see Appendix G) were collected and the answer categories were converted to numeric data and summarized. The results of the student evaluations appear in Table XXIII. All figures represent percentages.

No strong opinions were expressed regarding only attitude to the CAI program. 70% of the students had no opinion or had a slightly positive attitude. The majority of the students had a high intrinsic interest in the subject of musical styles. Most students did not find the instructional material too difficult and thought that there was a sufficient number of review exercises. On the other hand, half the

# Table XXIII
## STUDENT EVALUATION SURVEY

(Taken at the end of the CAI sessions)

| QUESTION | RESPONSE CATEGORIES | | | | |
|---|---|---|---|---|---|
| | Negative | Slightly Negative | No Opinion | Slightly Positive | Positive |
| Attitude towards the CAI Program | 10.0 | 10.0 | 40.0 | 30.0 | 10.0 |
| | | | Not Interested | Slightly Interested | Very Interested |
| Degree of Intrinsic interest in the subject | | | 10.0 | 30.0 | 60.0 |
| | None | Timed Out | Eight Mistypes | Log-on Diff. | Command Diff. |
| Degree of difficulty using a terminal | 20.0 | 20.0 | 30.0 | 10.0 | 30.0 |
| | | Too Difficult | Just Right | Too Easy | |
| Degree of difficulty of the instructional material | | 20.0 | 70.0 | 10.0 | |

|                          | Too Few   | Enough     | Too Many   |
|--------------------------|-----------|------------|------------|
| Amount of review exercises | 20.0    | 70.0       | 10.0       |

|                          | Too Long  | Just Right | Too Short  |
|--------------------------|-----------|------------|------------|
| Length of CAI lessons    | 50.0      | 40.0       | 10.0       |

|                          | Too Little | Enough    | Too Much   |
|--------------------------|-----------|------------|------------|
| Degree of Student control | 60.0     | 40.0       | 0.0        |

students thought that the CAI lessons were too long and slightly more than half felt that there was a lack of student control in choosing the instructional material.

## 7.3  CONCLUSIONS

The main hypothesis of the CAI experimental program predicted that a significant learning gain would result from the two lessons. The results have shown that this hypothesis holds true for the student sample at Concordia University. As our sample was considered to be representative of all students at the university level in Montreal, the results of our experiment should be applicable to the population at large. There were no serious threats to the external validity of our test instruments to dispute this. Since academic achievement, as measured by last term's marks, had no effect on the posttest scores of the CAI program, the second hypothesis was confirmed. The results of the pretest and posttest provided substantial evidence that the CAI program created an effective learning environment for those students who formed the experimental group. A predominant feeling among the students after the termination of the sessions was one of accomplishment and enjoyment.

Nevertheless, a number of constructive comments arose from the CAI sessions. A wider variety of response types was suggested for some questions. This is certainly feasible and would imply further lesson design and programming. It was noted that the question text student's answers could be saved and subsequently examined in conjunction with other students and a teacher, in order to pinpoint any weakness in the instructional material. This is only possible with the teletypewriter-

type terminal. A record of a student session could prove very useful in the evaluation and improvement of a CAI program (see Figure 15).

It was felt by some students that perhaps this examination of the characteristics of musical styles is too vast a subject to be covered in two sessions of one and a half hours each. Future studies could be concerned with one particular characteristic, such as textural change, which could conceivably be covered in a one-hour CAI session.

It is interesting to note that, while the majority of students interviewed before the session, had definite negative attitudes towards the idea of using the computer as an instructional tool, a definite positive shift in opinion occured after the sessions (see Table XXIII).

In conclusion, this experiment clearly demonstrates that a self-paced CAI program in music can be a valuable tool for students at the college level. This type of program could be used in the following areas of music:

1. Music appreciation (Erickson, 1969)

2. Aural Perception (Spohn, 1963)

3. Aural Description of Musical Styles

4. Basic Elements of music (Michalski, 1971)

5. Rhythmic Analysis (Ellenbogen, 1972)

6. Musicianship (Deihl and Radocy, 1971).

Further developments in CAI should be applied to very small instructional units which would be easier to control. On the basis of this study, it is imperative that a team of appropriate specialists (i.e. Instructional Designers, Music Professors, CAI Software Specialists, etc.) be employed to produce courseware of this nature.

## Figure 15

## PLAN FOR CAI PROGRAM IMPROVEMENT
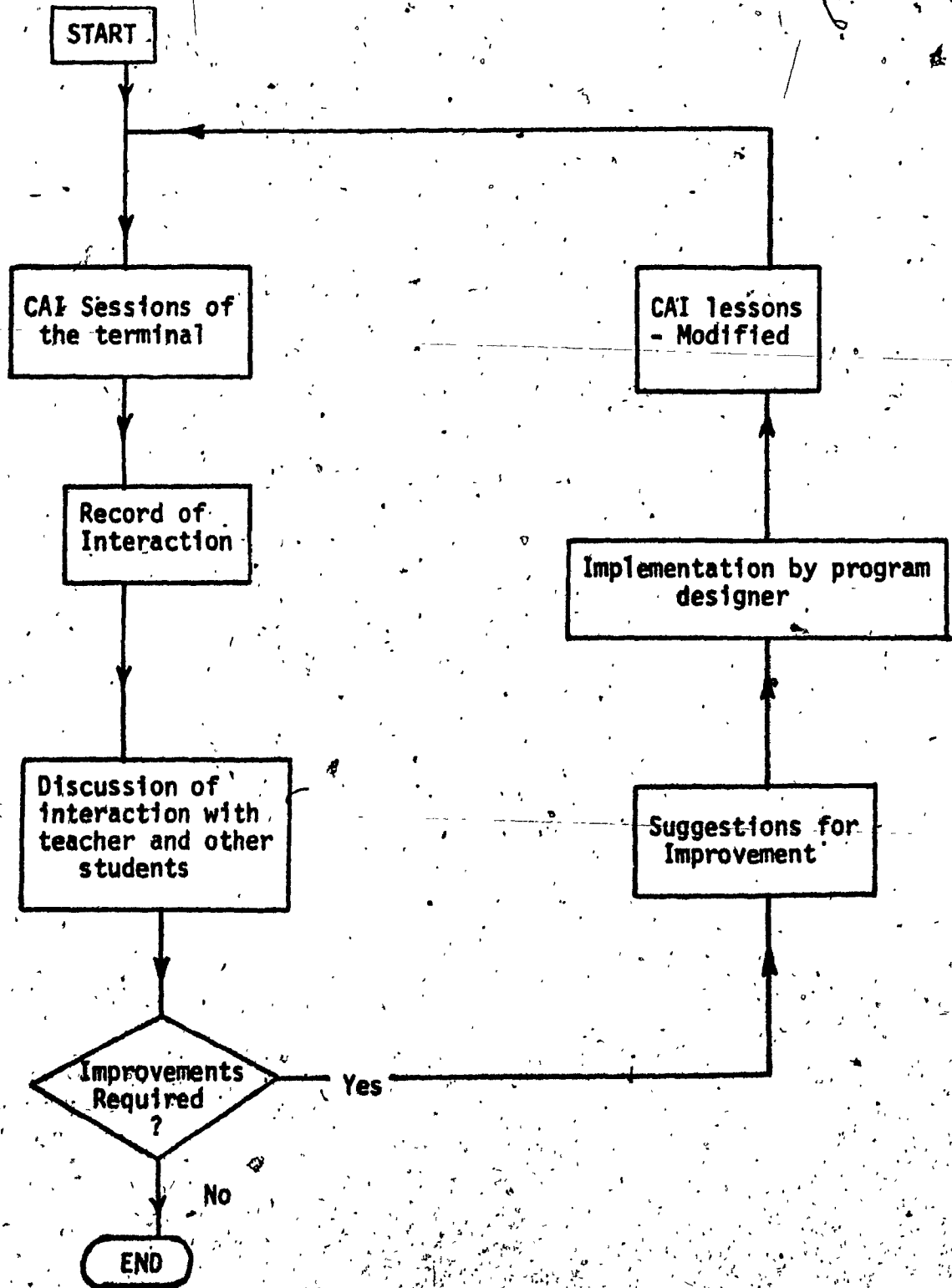
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# APPENDIX A

## TECHNICAL CONSTRAINTS TOWARDS CAI PROGRAM OPERATION

# APPENDIX A

## TECHNICAL CONSTRAINTS TOWARDS CAI PROGRAM OPERATION

1. The number of terminals available to the students are limited to six.

2. At 'peak' periods of the school term, there is some difficulty in gaining access to one of the terminals on the ninth floor.

3. Terminals do not always function properly. This is due to either physical damage or a line fault to the Central Computer.

4. The amount of time that students can spend on CAI is limited, as most music students have fixed schedules for classroom-type courses.

5. The number of cassette recorders are limited to what CIT can release at any one particular period of time.

6. Delays occur in receiving 'on the spot' help when terminal problems arise. These problems are of a functional or response-format type.

# APPENDIX B
## LIST OF RECORDED MUSICAL EXAMPLES

# RECORDED MUSICAL EXAMPLES & THEIR SOURCES

## CASSETTE #1 - Entry Behaviour Section

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 1 | 3 vocal lines<br>Last line ends with an incomplete cadence. | Danville Girl -<br>Cisco Houston |
| 2 | 2 short melodies<br>1st in C major<br>2nd in G major | Recorder -<br>I. Ellenbogen |
| 3 | 1 phrase - phrase ending has been cut off | Mozart -<br>Piano Sonata K.310 |
| 4 | 2 phrases | "On the Threshold of a Dream" -<br>Moody Blues |

CASSETTE #2 - Pretest

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 1 | 2 striking features - Voc., Inst., Dynamic Change, Text., Rhythmic pattern. | Stravinsky - L'Histoire du Soldat (Eroto) |
| 2 | Melody 1 Conjunct | Ragas - Songs of India (Folkways) |
| 3 | Melody 2 Disjunct | Berg- Wozzeck (DGG) |
| 4 | Use of sudden textural, dynamic ch. (Loud, Thick ⟶ p, thin, transp.) | Handel - overture to Solomon (RCA) |
| 5 | Tonal relationships Modulation, key change | Schubert-Symph. #4 1st move |
| 6 | Sound quality (Timbre) - Nasal | Music & Song of Italy (Lomax) - Lucania song |
| 7 | Comparison with #8 Similar feature - text., Monoph., Timb. | Gregorian Chant - Orations Sole- mnus (Archive) |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 8 | See #7 | Tribal Music of Australia - Sacred Song |
| 9 | Compare with #10 Different use of dynamics | Bach-Brandeburg Conc. #1 -3rd Move. (Angel). |
| 10 | See #9 | Karl Stamitz-Orch. Quartet in C. 3rd Move |
| 11 | Compare with #12 Textural Shift | Bruckner-Symph. #9 3rd Move (Seroph.) |
| 12 | See #11 | Webern - 5 orch. Pieces op. 5. |
| 13 | Compare with #14 Differences in melodic shape | Gregorian Chant - orations solemnes (Archives) |
| 14 | See #13 | Berio-Circles for Female voice, harp. perc. (Candide) |
| 15 | Compare with #16 Diff. in rhythmic patt. | Watusi music (Africa) - Drums (Folkways) |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 16 | See #15 | Bob Dylan - Subterranean Homesick Blues |
| 17 | Compare with #18 Diff. in text., form, repit. | Bach-Violin Sonata #2 for Unaccomp. viol. (Phillips) |
| 18 | See #17 | Reich-Violin Phase |
| 19 | Compare with #20, 21, 22 Contrasted feature - melodic shape | Beatles-Lucy in, the Sky with the Diamonds (Apple) |
| 20 | See #19 | Indian Street Music - The Bauls of Bengal |
| 21 | See #19 | R. Strauss - Don Juan |
| 22 | See #19 | Von Suppe-Morning, Noon, Night in Vienna |
| 23 | Compare with #24, 25 Highly constrasted melodic structure | Beethoven Symph. #4 4th move. (Col). |
| 24 | See #23 | Cage -Atlas Ecliptico-las (DGG) |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 25 | See #23 | Mozart-Symph. #40 (Col.) |
| 26 | Dynamics - 3 distinct levels | Stravinsky - Jeu de Cartes, ballet (COL.) |
| 27 | 3 features - ground bass, transp. text. 1-2 melod. plus accomp. | Purcell - Ode for St. Cecilia Day |
| 28 | See #27 | Purcell - Fantasia; 3 Parts on a Ground in D |
| 29 | Subjective factors - repose, melod. leaps. - Tension | Shirley E. Collins - "The Cruel Mother" (Folkways) |
| 30 | See #29 - Agit., Dramatic Melod. Cap. | Monteverdi - Il Combatimento di Tancredi |
| 31 | See #29 - Joy, Gay, Ornament, Mel. Stepwise | Enrique - Song by de los Angeles (Angel) |
| 32 | Compare with #33 Slight change in tempo, text., dyn. | Vivaldi - Concerto in g for Fl., Ob., Vi., Bassoon and 1st move. |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 33 | See #32 | Vivaldi-Concerto in F for Fl., Ob., Vi., & Conc. 1st move |
| 34 | Compare with #35<br>Slight change in melodic struct., rhythm, subj. factor | Gregorian Chant - Oratones solemnes (Archive) |
| 35 | See #34 | Gregorian Chant - Veneration of the Cross |

CASSETTE #3 - CAI LESSON
PRIMARY EXERCISES

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 1 | Harmonic prog. I - IV - V - I type | Mozart-Sonata in G. K.283 - Krause, piano |
| 2 | See #1 | Procum Harum Shine on Brightly |
| 3 | Triple meter (prompted - voice over $1_{23}$ $1_{23}$. . .) | Haydn - Minuet Symph. #8 in G. |
| 4 | Triple meter (no prompt) | Schubert - Symph. #2 3rd Move |
| 5 | Even rhythmic patterns (prompted) | Vivaldi - The Seasons |
| 6 | Uneven rhythmic pattern (prompt) | Stravinsky - L'Histoire de Soldat |
| 7 | Even rhythmic patterns | Verdi - La Travista |
| 8 | Textural Change Orch.-Solo $\longrightarrow$ (Cad) $\longrightarrow$ Silence $\longrightarrow$ Solo | Beethoven Concerto for Piano #3. 1st Move |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 9 | Interact. - Texture & Sound Quality Transp., Thin | Bach - Trio Sonata for Harps. Oboe, Flute |
| 10 | See #9 - Slightly thicker text. | Mozart - Wind Quintet for Piano & Winds K. 452 |
| 11 | Similar treatment of texture, dynamics to #12 | King Crimson - In the Court of King Cr. |
| 12 | See #11 | Procum Harum - Shine on Brightly |
| 13 | Common roots to #14. Similarily in Harm., Sound Qual., words | Big Bill Broonzy - All by Myself |
| 14 | See #13 | Pete Johnson - Roll 'em Pete |
| 15 | Tempo change - similar to Ex. 16 | Berlioz - Symphony Fantastique, 1st move |
| 16 | See #15 | Peter Seeger -Seek and You Shalt Find |
| 17 | Tempo Change-Similar to Ex. 18 | Bartok-Sonata for 2 pianos & perc., 1st Move. |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 18 | See #17 | Berg-Lyric Suite 6th Move |
| 19 | Melody & phrase - balance Contrast with #20 | Londonderry Air - played on recorder |
| 20 | See #19 | Adeste Fideles - Voice & drum |
| 23 | Texture & timbre - contrast with #24 | Dvorak-String 2H. in a, 2nd move |
| 24 | See #23 | Mozart-Quartet #22 in $B^b$ 2nd Move |
| 25 | Vocal Quality, Texture - Differences. Compare with #26, 27 | Gregorian Chant - Orationes Solemnes |
| 26 | See #25 | Monteverdi - Il Combatimento di Tancredi & Clorinda Recit. |
| 27 | See #25 | Mozart - The Magic Flute Bass Arioso |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 28 | Development of figured bass. The Drone. | Yugoslav Folk Song -"Cuvam Ovce Ka-oj" |
| 29 | See #28 | Haydn-Symph. #104, 4th Move |
| 30 | Comparison of bass parts with Ex. 31, 32 | Yugoslav Folk Song -"Cuvam Ovce Kroj" |
| 31 | See #30 | Purcell - Ode for St. Cecilia's Day |
| 32 | See #30 | Mozart-Sonata #8 in a, k. 310, 3rd move |
| 33 | Vocal Quality - falsetto singing Comparative analysis with #34,35 | Robert Johnson - Kindhearted Woman Blues |
| 34 | See #33 | Swiss Mountain Music "On the Franches Mount-ains". |
| 35 | | |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 36 | Melodic shape - contrasting Ex. 36 and Ex. 37 | Gregorian Chant - Oratóries solemnes |
| 37 | See #36 | Berg - Wozzeek, 1st Act. |
| 38 | Melodic structure - Staccato, Legato Comparison with #39 | Haydn - Piano Sonata in C, 1st Move |
| 39 | See #38 | Schoenberg-Herzgenachse |
| 40 | Contrast - Melodic periods within an example | Brahms - Symph. #3 1st Move |
| 41 | Sound quality and texture - Comparison with #42,43,44 | Haydn - Symph. #8 1st Move |
| 42 | See #41 | Debussy - Nocturnes 2. Fetes |
| 43 | See #41 | Lully - Overture to Armide |
| 44 | See #41 | Byrd. - Monsieur Almaine |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 45 | Rhythmic activity and texture - Compare with #47 | Bach - Cantata #31 |
| 46 | See #45 | M. Jagger & K. Richards - Sympathy for the Devil |

## CASSETTE #4 - CAI LESSON
## REMEDIAL EXERCISES

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 1 | Triple meter (prompted) | Haydn - Minuet from Symph. #96 |
| 2 | Duple. meter (slightly more diff.) | Charleboix - Le Solidaritude Alchimie |
| 3 | Even rhythmic pattern (-vv) partial prompt | Beethoven - Symph. #2 - 3rd Move. |
| 4 | Uneven rhythmic pattern partial prompt | Cage - Variations II for prepared piano |
| 5 | Melod. Phrase Structure, Harmony - Similarity to Ex. 6 | Beatles - A Little Help From My Friends |
| 6 | See #5 | Mozart - Serenade in C minor, k. 388 |
| 7 | Melodic shape - Contrast with #8 | Cisco Houston - Trouble in Mind |
| 8 | See #7 | Sioux Indians - Rabbit Dance |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 9 | Tempo, Meter - Similarity to Ex. 10 | Bach - Trio Sonata in C 3rd Move |
| 10 | See #9 | Handel - Oboe Concerto A 3rd Move (Siciliana) |
| 11 | Space and direction of sound - Compare with #12 | G. Gabrieli - Canzoni Noni Toni |
| 12 | See #11 | Elvin Jones - Who's Afraid |
| 13 | Texture, rhythmic rept. & variation - Compare with #14 | Africa, south of the Sahara - Tutsi Drums |
| 14 | See #13 | Bali - Gamelan Gong - Barong Dance |
| 15 | Comparative analysis - Dynamic, Texture, Subj. factor | Londonderry air - recorder |
| 16 | See #15 | Adeste Fiddles - voice & cymbal |
| 17 | Dynamic range - compare with #18 | Milhard - Le Creation du Monde |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 18 | See #17 | Poulenc - Les Biches |
| 19 | Instrumentation - Similarities to 20, 21 | Hendrix - Ain't No Telling |
| 20 | See #19 | Moody Blues - Have You Heard |
| 21 | See #19 | Procum Harum - Magdolene |
| 22 | Melodic structure - staccato Similarities to Ex. 23 | Bloch - Music for the lute |
| 23 | See #22 | Milan - Fantasia for Lute |
| 24 | Rhythmic activity | Drum rhythm |
| 25 | Increasing rhythmic activity | Mozart - String Quartet k. 387 4th Move |

## CASSETTE #5 - POSTTEST

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 1 | Melodic structure - contrast with #2 | Mahler - Symph. #8 concl. |
| 2 | See #1 | Mahler - Symph. #1 4th Move. |
| 3 | Drone - bottom part. | Bulgarian Folk music - Trio of bagpipes |
| 4 | Vocal quality - timbre | Uzbek song |
| 5 | Texture & Dynamics relationship | Handel-Water Music - Source |
| 6 | Tonal relationships | Recorder piece (Improvised) |
| 7 | Melodic Structure - Contrast with #8 | Strauss - Ein Heldenleben |
| 8 | See #7 | India - Tamil folk song |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 9 | Monophonic, Vocal Quality comparison with #10 | Shirley Elizabeth Collins - Scarborough Fair |
| 10 | See #9 | Jean Ritchie - Moonshiners |
| 11 | Textural Quality - transparency Compare with #12 | Boismortier - Concerto Op. 37 in e, 1st Move |
| 12 | See #11 | Couperin - Sonata #VIII in D |
| 13 | Dynamic change - Compare with Ex. 14 | K. Stamitz - orchestral QH. in C. |
| 14 | See #13 | Boccherini - Symphony in C major - 1st Move |
| 15 | Comparison with #16 on several features | Frescobaldi - Aria for Guitar |
| 16 | See #15 | Scarlatti - Sonata in e for guitar |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|---|---|---|
| 17 | Rhythmic structure - polyrhythm Compare with #18 | Stravinsky -L'Histoire du Soldat |
| 18 | See #17 | Schumann - Symph. #3 1st Move |
| 19 | Melodic Structure - comparison with #20, 21 | Beethoven - Symph. #9 4th Move |
| 20 | See #19 | Beethoven - Symph. #9 - 2nd Move |
| 21 | See #19 | Beethoven - Symph. #9 - 1st Move |
| 22 | Instrum. Melody plus Accomp. similar to Ex. 23 | Vivaldi - The Seasons |
| 23 | See #22 | Bach - Suite #3 for orch. Air in G. |
| 24 | Dynamic levels | Sibelius - Finlandia |
| 25 | Tempo change - Rallentando Compare with #26 | Berlioz - Symphony Fantastique - 1st Move |

| SEQ. NO. | DESCRIPTION OF EXAMPLE | SOURCE |
|----------|------------------------|--------|
| 26 | See #25 | Verdi - Requiem |
| 27 | Vocal Quality, Dynamics, Melodic Structure - contrast with #28, 29 | Berio - Circles for Voice, harps, percussion |
| 28 | See #27 | Bach - Cantata #170 "Vergnugte Ruh" |
| 29 | See #27 | Faure - Claire de Lune |

# APPENDIX C
## FLOW DIAGRAM OF THE CAI PROGRAM

# APPENDIX C
# FLOW DIAGRAM OF THE CAI PROGRAM

## FLOWCHART SYMBOLS
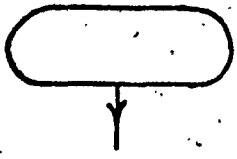
- Entry point or exit from a program section (i.e. Pretest)

- Question Number. The question may be a principal, remedial, or review type. For example:

2   refers to Question #2

2<sup>A</sup>   refers to Question #2A
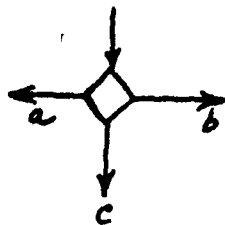
- Branch point. Decisions a, b, or c

are based upon the student's answer.

Answer possibilities are:

   Inc (1) - Incorrect, 1st time

   Inc (2) - Incorrect, 2nd time

   COR      - Correct

   ~COR    - Almost or approximately
               correct

   INC. A  - Incorrect, type. A

   INC. B  - Incorrect, type B
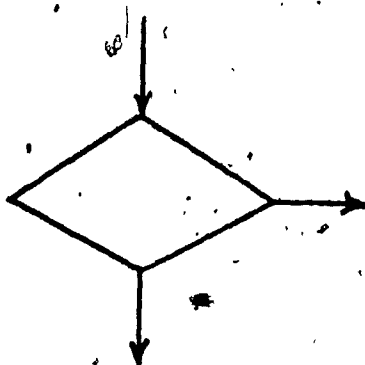
- Branch point. Learner-controlled
           strategy.
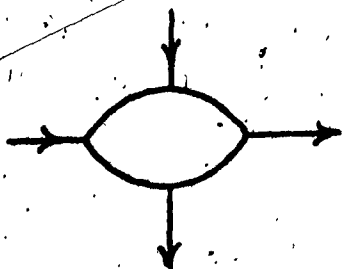
- Program Logic Decision Point.
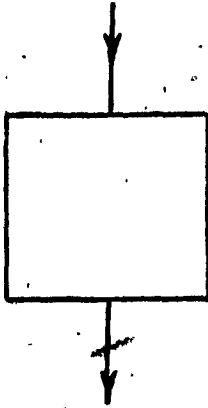
- An operation (Process)

  i.e. - Load a variable

      - Issue explanatory text

- Point of interface with an audio
       source

     { Cassette # ____

     { Example # ____

- Connectors; refers to another point

     in the flowchart
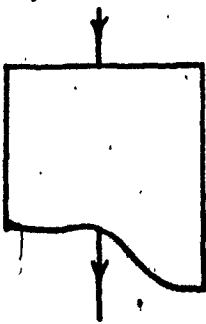
- Provides information on TTY for purposes

  of maintenance and corrections.
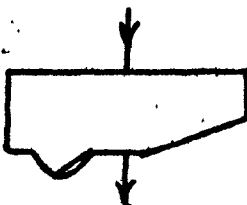
- Provides information on TTY to user

      - Instructional
        Reinforce of resp.
        Correct resp.
        etc.

# ABBREVIATIONS

| | | |
|------|---|---|
| COR. | – | Correct |
| INC. | – | Incorrect |
| Q. | – | Question # |
| V1, V2, etc. | – | Variable # |
| CONST. | – | Construction |
| REINF. | – | Reinforcement |
| ACKN. | – | Acknowledge |
| INFO. | – | Information |
| TTY | – | Terminal (Teletypewrite - 33) |
| CASS. | – | Cassette-tape # |
| EX. | – | Example # |
| RESP. | – | Response |
| EXPL. | – | Explanatory |
| EX. | – | Recorded musical example |
| CASS. | – | Cassette-tape |
| INV. | – | Invalid response |

# Entry Behaviour Section

3.



**C**

Further info. cadences

INC → Load V4 Inc

COR

Ackn.

Correct resp.

Load V4 COR

Key relation-ships

**5**

(INC(1)   INC(2) → Load V5 INC

Precautionary info.

COR

Reinf. response

Load V5 COR

Computer response

Modulations

**6**

COR   INC(A)   Ackn. response

INC(B)

Load V6 INC

Explain method

Hints

Load V6 COR

Reinf. resp.

**7**

CASS. 1
Ex. 2

**D**

4.

D·

COR

Some
Agreement

'Correct'
resp.

Reconsider
ques.

E

Ackn.
resp.

INC.A
(1)

INC. A
(2)

Express dis-
agreement

Load V7
INC

9    Phase Structure

Expl.
comments

Correct resp.

COR

G

Cass. 1
Ex.#3

Hint

INC

Load V9
INC

E

Ackn. response

Ackn. resp.

Load V8   COR

Correct
resp.

Correct
resp.

Load V7
COR

F

8

COR

Load V8
COR

Cadences

COR

INC

Load V8
Inc

Correct resp.

5.

# CAI. - Lesson

1.

Entry
File-Music L

Lesson
Name

Introd. to
musical
style

Individ.
styles  1

COR   Ack. response
INC

Correct
response

Load V1
COR

Load V1
INC

Hierarchy of
styles

2^A

sub-cultural
style?   2

Demonstrate
1 example

COR
INC   Load V2
INC

INC

COR   Ackn. response

Demonstrate
3 examples

Load V2
COR

Stylistic
features

2^B

INC   A

List other
features

COR.A   COR.B   COR.C

Reinf.
resp.

Ackn. Reinf.
resp.

Explanatory
remarks

2.

A

B1

Load V3
INC

Common features
among styles

Ackn.
response

Common harmonic
features

Correct resp.
EXPL.

CASS.3
Ex.1
Ex.2

Enabling
Objective
#2

Prep. for re-
medial exer

Meter
detect.      3^A

Cass.4
Ex.1

State
Objective

INC        COR

Load V4
COR

Instructions-
tap the
meter

Correct
resp.

Reinf. resp.

CASS.3
Ex.3

Explanatory
remarks

Load V4
INC

Meter

Load V3
Inc

Typing
inst.

B        3

INC(2)

CASS.3
Ex.4

INC

Don't kn

Typing inst.

B

COR.

INC(1)

Ackn. resp.

Load V3
COR

Ackn. resp.

C

B1

3.

4.



D

5 → Ident. Rhythmic Patt.

Resp. instruc.

COR → Load V7 COR

INC → Load V7 INC

Correct resp.

Reinf. resp.

Easier Ques.? — NO → E

YES

5<sup>A</sup> — CASS.4 Ex.3

COR → Load V8 COR → Ackn. resp.

INC → Load V8 INC → Ackn. resp. → Correct resp.

5<sup>B</sup>

INC.A / COR

Advice    INC B    Load V9 COR

Load V9 INC

Correct resp.

Reinf. resp.

E

Enabling Objectives #7, 8, 9

State enabl. objective

Info.-Texture variety

F

5.

F

Textural Change

6

CASS.3 Ex.8

INC.A  INC.B

Load V10 INC

COR

Typing Info.

Load V10 COR

Reinf. resp.

Ackn. response

Info.-Sound, Qual.,Texture

Correct response

Further information

CASS.3 Ex.11

List Features

7

Slight disagreement

Response expected

INC

Load V11 INC

COR

Load V11 COR

Ackn. resp.

Match features to descriptions

8

INC.A  COR

No swearing

INC.B

Load V12 INC

Response expected

Load V12 COR

Reinf. response

Terminal Objective #1

State terminal obj.

G

6.



G

9 — List 5 features

INC / COR

V51 = V51 + 1 — for each correct feature

9^A — List 5 features

INC / COR

V51 = V51 + 1 for each cor. feat

V51 ≥ 7

No (1)

No (2)

Yes

No. of features identified

Hints

Load V13 COR

Load V13 INC

List of features

End of 1st section

Provide info. on student progress

13
$V_1 \longrightarrow V58$
i=1

Vn(Review Ex) $\longrightarrow$ V59

V58 < 10 — Yes

No

V58 < 13 — Yes

No

Progressing well

Progress-quite good
1-2 inc. ques.

Indicate prob. areas

V59 < 5 — No

Yes

Indicate improvement in Review Ex.

Indicate problems-Review

H

7.

H

Summative Evaluation -Section 1

Recapitulation of Goals

$9^B$ — Relevance of subject matter

Very Imp — not rele.

Load V80 →3.

Some Imp.

Load V80 →1

Load V80 →2

Formative Evaluation

$9^C$ — Suggestions for improvement

Other

Finish

Save suggestions

Enabling Objective #10

State enabl. objective

Illustration of common fac.

CASS.3
Ex.11
Ex.12

Further Info.

CASS.3
Ex.13
Ex.14

10

Features commonly utilised

INC.A

COR

I

CASS.3
Ex.15
Ex.16

Typing Inst.

INC.B Don't kn.

Expl.

Load V14 INC

Resp. expected

J

8.

9

M

N

Load V16
INC

Load V16
COR

Metrical
treat.

Expressed res-
ponse

Provide cor.
response

11^B

CASS.4
Ex.9
Ex.10

Melod.
shape

11^A

CASS.4
Ex.7
Ex.8

COR

Load V18
COR

INC

Load V18
INC

Background
info.

Load V17
COR

Response
expected

Ackn.

COR

INC

Load V17
INC.

Reinf. resp.

COR

Q

INC

Load V19
INC

Ackn., Expl.

P

L

11^C

CASS.4
Ex.11
Ex.12

Response Expec-
ted

Sound, source
direction

Background
information

P

10.

Q

O

Load V19 COR

Load V16 COR

Load V21 INC

Ackn.

Ackn.

Ackn.

P

Terminal Objective #3

EXPL

Expl.

CASS.4
Ex.13
Ex.14

List Common Charact.

$11^D$

Y

State term. obj.

COR

Load V20 COR

S

COR.A

T

COR.B

U

COR.C

Phase struct.

INC

Load V20 INC

Ackn.

V

COR.D

CASS.3
Ex.19
Ex.20

Ackn.

W

COR.E

Further Info.

Ackn.

Reinf. resp.

X

COR.F

Rhythm

Point out common char.

INC

R

EXPL

CASS.3
Ex.21
Ex.22

Describe simil. & Differences

No swearing

INC.A

R

12

INC.B
Don't kn.

Ackn.

11.

12.

3rd Exercise

# APPENDIX D
## LIST OF PRETEST ITEMS

# APPENDIX D
## LIST OF PRETEST ITEMS

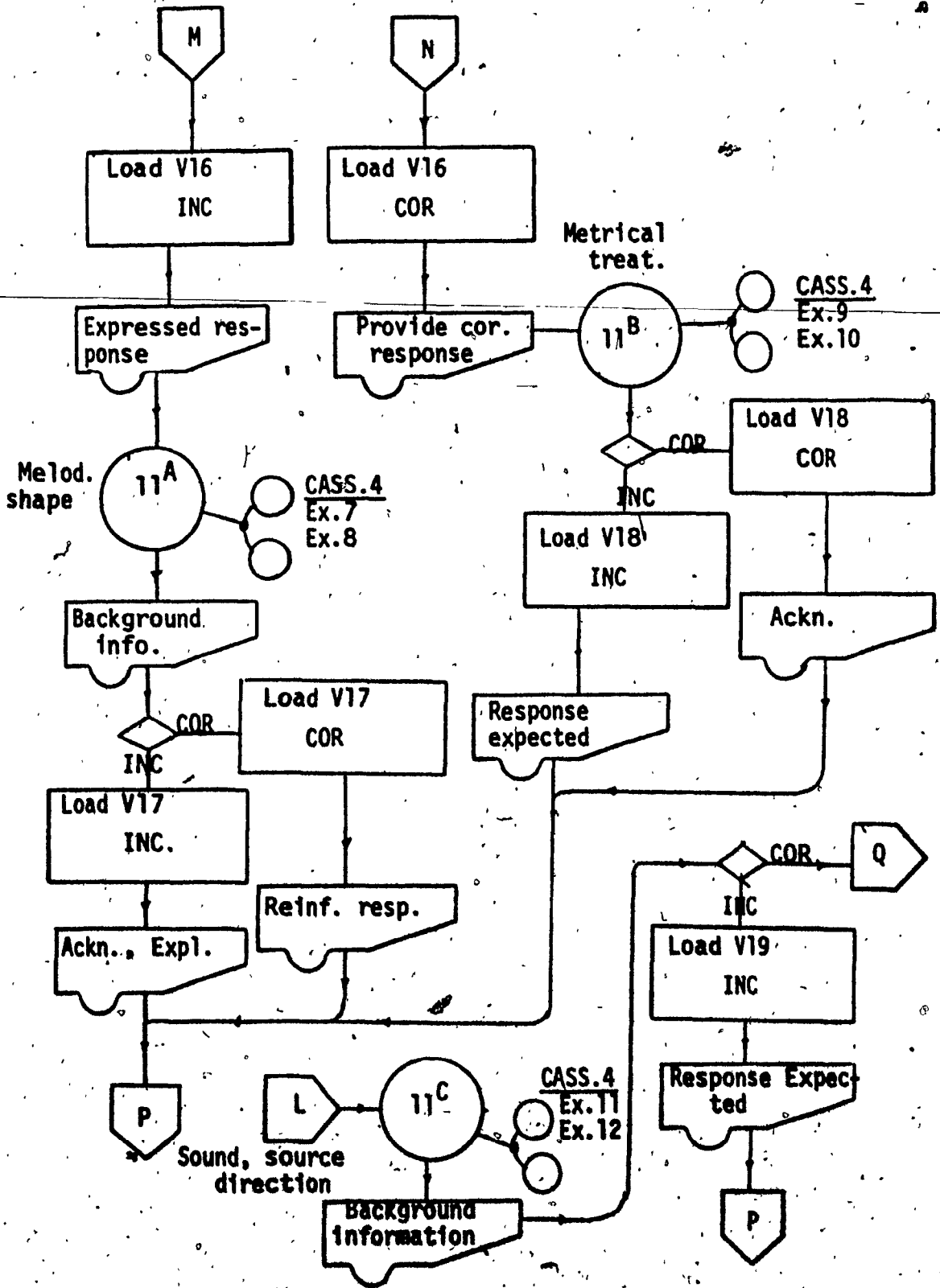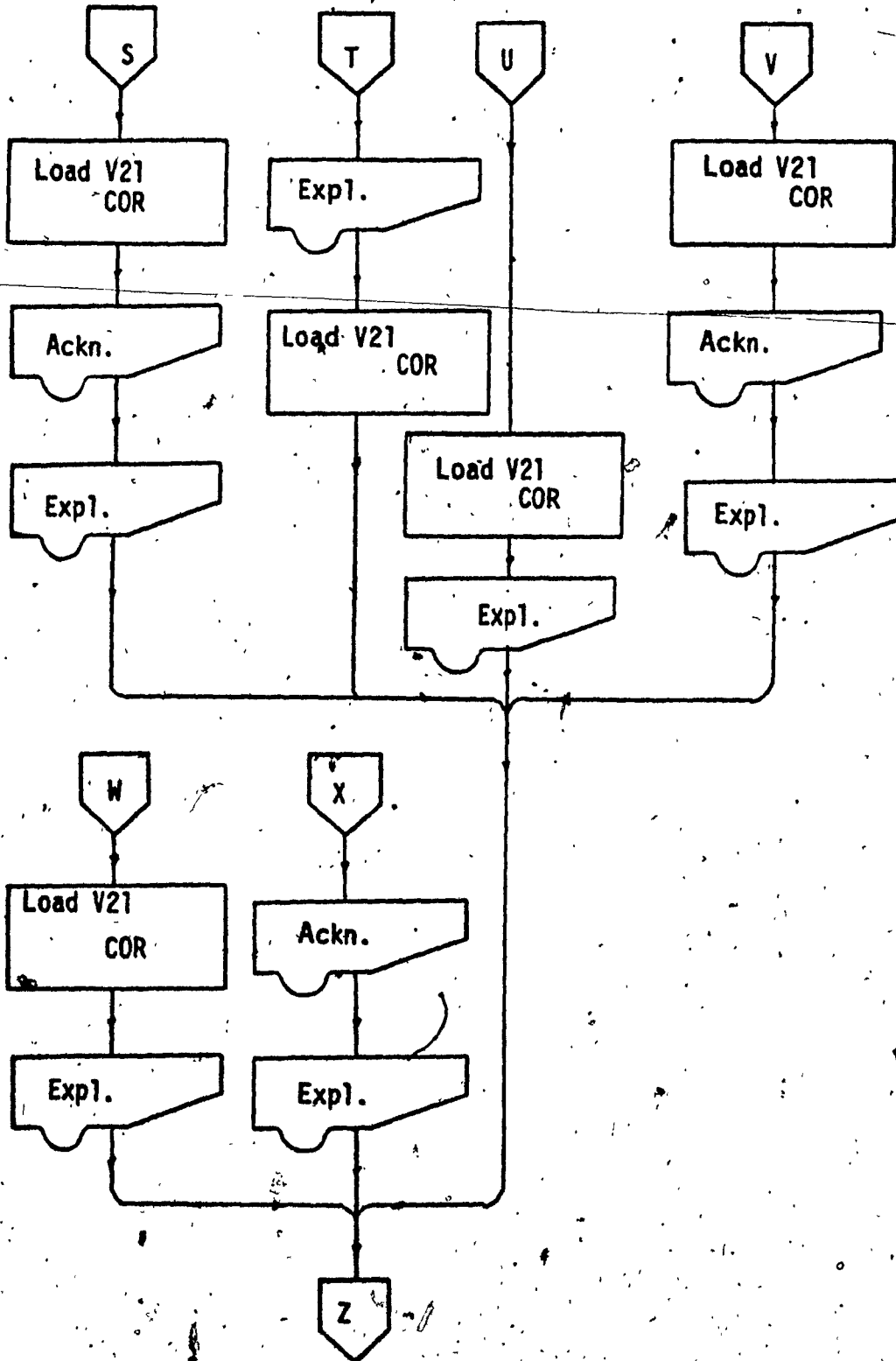| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 1 | Please listen to recorded example No. 1 on Tape No. 2. In your own words, describe at least two striking features that you heard. | Description |
| 2 | Please listen to Examples #2 and 3 on Tape 2. The melody in Ex. 2 is basically stepwise and legato. In Ex. 3, however, the vocal melody is . . . . . . . . . Complete the above statement. | Statement Completion (Hint Included) |
| 3 | List 4 features that are specific to a musical style. | List |
| 4 | Please listen to recorded example #4 on Tape 2. There is a sudden change in both the texture and dynamics at one point in the music. What kind of change was it? | Description (Hint Included) |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 5 | Please listen to recorded example #5 on Tape 2. What is the tonal relationship between the sections? | Description - Brief |
| 6 | Please listen to recorded example No. 6. Which of the following describes the sound quality fairly accurately?<br><br>A. Vocal Sound, Nasal, Pinched<br><br>B. Instrumental Sound, Violins, Vibrato<br><br>C. Many Vocal Sounds (Choral), Open, Throaty<br><br>D. Very Poor Quality | Multiple Choice |
| 7 | Listen to recorded example No. 7 and No. 8. List those features that are similarly treated in both examples. | List |
| 8 | Please listen to recorded examples Nos. 9 and 10. The dynamics are treated differently in these examples. Describe the different usages of dynamics. | Description (Hint Included) |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 9 | Please listen to recorded examples Nos. 11 and 12. What is the texture like in each case? | Description |
| 10 | Please listen to recorded example No. 13 and No. 14. In what way does the melodic structure differ in the above 2 examples? | Description |
| 11 | Please listen to recorded examples No. 15 and 16. The basic rhythmic pattern in example 15 is quite different from that of example No. 16. Specify these differences. | Description |
| 12 | Please listen to recorded examples No. 17 and 18. One particular feature is being applied differently in example 18 than in example 17. What is this feature? | Specification |
| 13 | Please listen to recorded examples Nos. 19, 20 and 21. Do you know which feature is highly contrasted throughout the 3 examples? Please type either yes or no; then elaborate. | Description |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 14 | Please listen to recorded examples No. 23, 24. 25. Which feature is being highly contrasted? | Specification |
| 15 | Please listen to recorded example No. 26. How many different dynamic levels did you detect? | Specification |
| 16 | Please tune up your ears and listen to recorded Ex. 27 and 28 (You might have to turn the tape over for Ex. 28). A number of features are listed below. Which ones occur in both examples?<br><br>1.  Crescendo followed by diminuendo<br><br>2.  Use of a ground<br><br>3.  Thin, transparent textures<br><br>4.  Strong Odor of Jasmin<br><br>5.  Steady rhythmic pattern<br><br>6.  1 or 2 melodies with accompaniment | Multiple Choice<br><br>( 1 or more answers) |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 17 | Listen (with both ears) to recorded examples Nos. 29, 30, 31. The melody in Ex. 29 is . . . . . . . . (calm, Tense). The melody in Ex. 30 is . . . . . . . . . (Peaceful, Dramatic). In Ex. 31, the melody is . . . . . . . . . (Gay, Sad, Neither. Please complete the above statements. | Statement Completion (Hint included) |
| 18 | Why was the 2nd example (#30) more agitated than the others? | Description |
| 19 | Please listen to examples #30 and 33 on tape 2. One feature in Ex. 32 is treated slightly differently in Ex. 33. Name this feature and describe how it is used in both examples. | Description |
| 20 | Please listen to recorded examples #34 and 35 on Tape 2. How do they differ? | Description |

# LIST OF POSTTEST ITEMS

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 1 | Please listen to recorded examples #1 and #2 on Tape 5. The melody in the 1st example is . . . . . . (stepwise, disjunct) whereas the melody in the 2nd example is. . . . . . Complete the above statement. | Statement Completion (Hint included) |
| 2 | Listen to recorded example #3 on tape 5. The sound quality of the piece of music is: 1. Open, throaty, many vocal sounds 2. Poor sound quality 3. Nasal, vocal sound, pinched 4. Instrumental, sound, violins, vibrato Type in the correct statement No. | Multiple Choice |

| QUESTION No. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 3 | Please listen to recorded example #4 on tape 5. How are the sections related in tonality? | Description - brief |
| 4 | A musical style consists of a number of characteristics or features. Name these features (4 will be sufficient). | List |
| 5 | Please listen to recorded example No. 5 on tape 5. There are a number of features that 'stand out' in the music. Describe 2 of them. | Description |
| 6 | Please listen to recorded example #6 on tape 5. The texture and dynamics of the music change radically. Describe the nature of this change. | Description (Hint included) |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 7 | Please listen to recorded examples #7 and #8 on tape 5. Each example uses dynamics in a different way. Describe the different usages of dynamics. | Description (Hint included) |
| 8 | Please listen to recorded example #9 and #10. In these 2 examples, how does the melodic structure differ? | Description |
| 9 | Please listen to recorded examples #11 and 12 on tape 5. There are certain features that are similarly treated in both examples. Name these features. | List |
| 10 | Please listen to recorded examples Nos. 13 and 14. Describe the texture in each example. | Description |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 11 | Listen to recorded examples Nos. 15 and 16 on tape 5.<br><br>Listed below are 4 characteristics:<br><br>1. Thin, transparent textures.<br><br>2. Use of a ground<br><br>3. 1 or 2 melodies with accompaniment<br><br>4. steady, rhythmic pattern<br><br>5. Crescendo followed by diminuendo<br><br>6. Strong odor of Jasmin | Multiple Choice<br><br>(1 or more answers) |
| 12 | In the 2 examples that you heard, could you tell me why Ex. 15 sounds 'agitated' in comparison to Ex. 16? | Description |
| 13 | Please listen to recorded Ex. 17 and 18.    You will find that the basic rhythmic pattern in Ex. 17 is not the same as that of Ex. 18. Describe how they differ. | Description |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 14 | Please listen to recorded examples No. 17 and 18 on Tape 5. What feature is used differently in the examples than you heard? | Specification |
| 15 | Listen now to 3 examples:<br><br>No. 19<br><br>No. 20<br><br>No. 21<br><br>One feature is given a radically different treatment from one example to the next. Name this feature and give reasons for your choice. | Description |
| 16 | Please listen to recorded example No. 22. One hears, in this example, a number of dynamic levels. How many can you detect? | Specification |
| 17 | Listen to examples #23, 24, 25, on Tape 5. One particular feature is used differently each example. Name this feature. | Specification |

| QUESTION NO. | QUESTION TEXT | QUESTION TYPE |
|---|---|---|
| 18 | Now listen to recorded examples #26 and 27. How do they differ? | Description |
| 19 | Please listen to examples 28, 29 and 30. In Ex. 28, the melody is ............ (Tense, calm) In Ex. 29, the melody is ......... (Peaceful, dramatic). The melody in Ex. 30 is .......... (sad, gay, neither). Please complete the above statements. | Statement completion (Hint included) |
| 20 | Listen to examples No. 31 and 32 on Tape 5. Name the feature that is used slightly differently from one example to the next. Describe how it is used. | Description |

APPENDIX E

INSTRUCTIONS FOR USING THE TERMINAL

# TERMINAL USAGE

## CAI Program in Music

I. Ellenbogen

Tel. 875-4311
Local 1714

CIT Room 605.1

# SUGGESTIONS FOR TYPING IN YOUR RESPONSE

(A 'monitor' will be available to answer questions)

1. Type as accurately as possible. (The program will normally accept one spelling mistake in a word).

2. Be brief. Only 1 line of response is accepted.

3. If you make a typing mistake, press the 'ESC' key, and type in your new response.

4. In order to type an <u>upper case</u> character (i.e. $), press both 'SHIFT' and the character.

5. Always type in a <u>space</u> between words. The space key is the long bar at the bottom of the keyboard.

6. When you have typed in your response, press the 'RETURN' key. (Do not take longer than 8 min. to respond).

# How to Use the Computer Terminal

1. Press button, '**ORIG**'

2. Dial 7366

3. Wait for message: USER NUMBER

4. Type `K Z 2 9 1 1 2 , R E E K` and press '**RETURN**'

5. Wait for message: Recover/System

6. Type `- C A N S Y S` and press '**RETURN**',

7. Wait for message: READY

8. Type `- X C I T C A N` and press '**RETURN**'

9. Wait for message: PLEASE IDENTIFY

10. Type `C D C S E C . 6 0 0 0 0 0 0` and press '**RETURN**'

11. Wait for message: ENTER TUTORIAL CODE

12. Type `M U S I C P / K Z 2 9 1 1 2` and press '**RETURN**'

# APPENDIX F

## SAMPLE PROTOCAL OF A CAI LESSON IN PROGRESS

# CAI Lesson, Part I

```
74/11/05. 19.05.53.

TELEX TIL 11PM.

USER NUMBER: KZ29112,REEK
TERMINAL:     34,TTY
RECOVER /SYSTEM:-CANSYS

READY.

-XCITCAN


 CITCAN VER 1.8 CONU
 PLEASE IDENTIFY
? CDCSEC,6000000

 LOGIN AT  19.08.38. 74/11/05.
 HELLO,STUDENT.

 ENTER TUTORIAL CODE...
? MUSICL/Z29112
 MUSICL NOT FOUND.
READY.

-XCITCAN


 CITCAN VER 1.8 CONU
 PLEASE IDENTIFY
? CDCSEC,6000000

 LOGIN AT  19.10.13. 74/11/05.
 HELLO,STUDENT.

 ENTER TUTORIAL CODE...
? MUSICL/KZ29112

 EXECUTING...


******************************************************
*                                                    *
*          CAI  LESSON  IN  MUSICAL  STYLE           *
*                                                    *
******************************************************
```

QUES. NO. 1
A STYLE CONSISTS OF A SET OF NORMS THROUGH WHICH A
PARTICULAR MUSICAL LANGUAGE IS CREATED.

IS THE MUSIC OF MOZART EXPRESSED IN A PARTICULAR STYLE?
? YES

YES, THAT'S RIGHT.

QUES. NO. 2

THERE EXISTS MANY DIFFERENT STYLES. STYLES VARY FROM CULTURE
TO CULTURE. IN ADDITION, WITHIN A CULTURE, ONE MAY FIND
A NUMBER OF UNIQUE INDIVIDUAL STYLES (IE. MOZART).
FURTHERMORE, WITHIN SMALLER GROUPS SUCH AS SUB-CULTURAL GROUPS,
ONE MAY FIND A VARIETY OF STYLES.

WHICH ONES OF THE FOLLOWING ARE SUB-CULTURAL STYLES?
        1. ASIAN MUSIC
        2. REGGIAN MUSIC FROM THE WEST INDIES
        3. MUSIC FROM NOVA SCOTIA
        4. MUSIC FROM NORTH AFRICA
        5. AMISH CHURCH MUSIC

? 2,3,5

I'M INCLINED TO THINK THAT THE FOLLOWING ARE
REPRESENTATIVE OF SUB-CULTURAL STYLES:
        2. REGGIAN MUSIC
        5. AMISH CHURCH MUSIC
ANOTHER EXAMPLE WOULD BE MUSIC FROM THE APPALACHIAN REGION.

        1              2

A STYLE EVOLVES THROUGH THE USE OF VARIOUS TECHNIQUES.
TECHNIQUES ARE REALLY THE MANIPULATION OF VARIOUS MUSICAL
FEATURES. SOME OF THESE FEATURES ARE:
```
        1. TEXTURAL CHANGE
        2. MELODIC SHAPE
        3.  THE SOUND SPACE
```

CAN YOU THINK OF SOME OTHER FEATURES? IF YOU CAN,
LIST THEM. OTHERWISE, TYPE DON'T KNOW.
? RHYTHM,INSTRUMENTALOR VOCALOR BOTH
RIGHT. RHYTHMIC STRUCTURE OR PATTERN IS AN IMPORTANT   :
CHARACTERISTIC IN MUSIC.
SOME OTHER FEATURES WOULD BE:
```
            1. TONAL (ATONAL) RELATIONSHIPS
            2. SUBJECTIVE FACTORS
            3. SOUND QUALITY
```
    (AS WE EXAMINE SOME OF THESE FEATURES, INDIVIDUALLY,
     KEEP IN MIND THAT THEY ARE ACTUALLY INTERDEPENDENT)


WHILE WE RECOGNIZE THE DIVERSITY OF MUSICAL STYLES, WE MUST
ALSO ADMIT THAT SOME OF THESE HAVE IMPORTANT FEATURES IN
COMMON. IN MANY CULTURES, FOR EXAMPLE, THE TONIC, THE FIFTH,
AND THE FOURTH ARE TREATED AS STABLE FOCAL TONES TOWARDS WHICH
OTHER SOUNDS TEND TO MOVE.

    LISTEN TO RECORDED EXAMPLES NO. 1 AND 2 ON TAPE 3.
        (TYPE CONTINUE WHEN YOU HAVE FINISHED)
? CONTINUE


IN BOTH EXAMPLES THAT YOU HEARD, THE HARMONY CONSISTS
BASICALLY OF I, IV, AND V CHORDS.


IN THE NEXT SECTION, OUR OBJECTIVE WILL BE TO IDENTIFY
THE TYPE OF PULSE DIVISIONS IN A PIECE OF MUSIC.


LISTEN TO RECORDED EXAMPLE NO. 3 ON TAPE 3.
TAP YOUR FEET OR CLAP YOUR HANDS TO THE MUSIC.
        (TYPE CONTINUE WHEN YOU HAVE FINISHED)

? CONTINUE

NOTE THAT IN THIS MUSIC, IT IS QUITE EASY TO DISTINGUISH
THE MAIN BEATS. IN THIS CASE, THE BEATS ARE GROUPED IN
THREES.  IE. 1 2 3     1 2 3     1 2 3  ETC
  THUS THIS MUSIC IS IN TRIPLE PULSE DIVISIONS.


QUES. NO. 3


PLEASE LISTEN TO RECORDED EXAMPLE NO. 4 ON TAPE 3.
IS THE MUSIC IN TRIPLE OR DUPLE TIME?
NOTE THE DUPLE TIME OCCURS WHEN BEATS ARE GROUPED IN
TWOS, FOURS,ETC.      IE. 1234 1234 1234 1234
   (PLEASE TYPE EITHER TRIPLE OR DUPLE)
? TRIPLE




RIGHT ON  THAT IS QUITE GOOD. STUDENT.


IF YOU WOULD LIKE TO HAVE MORE DIFFICULT QUESTIONS ON THIS
PARTICULAR CONCEPT, PLEASE TYPE DIFF
                              OTHERWISE TYPE NO.
? NO




            1          2      1        0          0
IN THE NEXT SECTION, WE WILL TRY TO DIFFERENTIATE BETWEEN
EVEN AND UNEVEN RHYTHMIC PATTERNS.


AN EVEN RHYTHMIC PATTERN OCCURS WHEN A GROUP OF BEATS
(MAKING UP A RHYTHMIC GROUP) IS REPEATED CONTINUALLY
WITHOUT ANY BASIC CHANGES TO THE GROUP.

LISTEN TO RECORDED EXAMPLE NO. 5 ON TAPE 3. NOTE HOW EACH
RHYTHMIC GROUP IS STATED REPEATEDLY.
IF NECESSARY, LISTEN TO THE EXAMPLE AGAIN.
    (TYPE OK WHEN YOU HAVE FINISHED)
? OK

DID YOU FIND IT VERY DIFFICULT?
? NO


ALRIGHT.
        AN UNEVEN RHYTHMIC PATTERN OCCURS WHEN DIFFERENT
GROUPS ARE HEARD IN SUCCESSION; THAT IS, A STEADY
RHYTHMIC PATTERN IS NOT DETECTED.

LISTEN TO RECORDED EXAMPLE NO. 6 ON TAPE 3.
NOTE THAT THERE IS NO ONE STEADY RHYTHM.
      (TYPE GO AFTER YOU HAVE FINISHED)

? GO


QUES. NO. 4
NOW LISTEN TO RECORDED EXAMPLE #7 ON TAPE 3.
HAVE YOU HEARD AN EVEN OR UNEVEN RHYTHMIC PATTERN IN THIS
SUPERB PIECE OF MUSIC?    (TYPE EVEN OR UNEVEN)
? EVEN


THAT'S IT.


QUES. NO. 5


IN THE EXAMPLE THAT YOU JUST HEARD (LISTEN AGAIN TO EX. 7
IF YOU FORGOT IT) , IDENTIFY THE BASIC RHYTHMIC GROUP.
·USE SUCH TERMS AS STRONG OR WEAK FOR DESCRIBING THE BEATS.
 IE, WEAK STRONG WEAK


? STRONG WEAK WEAK


YES. YOU ARE DOING JUST FINE, MAN. (OR WOMAN)


IF YOU WOULD LIKE AN EASIER QUESTION, PLEASE TYPE EASY.
OTHERWISE TYPE NO.
? NO


IF YOU WOULD LIKE TO TAKE A BREAK (IE, GET SOME COFFEE),
TYPE $HALT, WAIT FOR A MESSAGE, THEN TYPE BYE.
IF YOU WISH TO CARRY ON, TYPE CONTINUE.
? CONTINUE

OUR OBJECTIVE IS AS FOLLOWS-
THE STUDENT, AT THE END OF THIS SECTION, WILL BE ABLE
TO PERCEIVE AND DESCRIBE DIFFERENT TEXTURAL QUALITIES
IN MUSIC.


SOUNDS CAN BE HEARD IN A VARIETY OF TEXTURES.
1. THIN TEXTURE - 2 OR 3 SOUNDS, EACH OF A DIFFERENT QUALITY
(OR TIMBRE)
2. THICK TEXTURE - MANY LINES, FAIRLY CLOSE TOGETHER,
OF SIMILAR SOUND QUALITIES.
OF COURSE, THERE ARE A GREAT NUMBER OF GRADATIONS IN
TEXTURE BETWEEN THE EXTREMES OF THIN AND THICK.


QUES. NO. 6
PLEASE LISTEN (ACUTELY) TO RECORDED EXAMPLE #8 ON TAPE 3.

1. THE TEXTURE IS QUITE 'HEAVY' OR THICK (PIANO SOLO).
2. A SHORT SILENCE (EXCEPT FOR TAPE NOISE).
3. THE TEXTURE GRADUALLY THICKENS (MORE LINES GRADUALLY
OCCUR)

PLACE THE ABOVE STATEMENTS IN THEIR PROPER ORDER
AS THEY OCCUR IN THE MUSICAL EXAMPLE.
(TYPE THE NUMBERS ONLY.      IE.  1 4 2 3.)
? 3 2 1


CORRECT...


SOUND QUALITY AND TEXTURE ARE CLOSELY RELATED. IF 3 LINES
ARE VERY DIFFERENT IN SOUND QUALITY FROM EACH OTHER, THEN
THE RESULTING TEXTURE IS QUITE THIN AND TRANSPARENT.
HOWEVER, WHEN THE 3 LINES ARE SIMILAR IN SOUND QUALITY, THE
TEXTURE SEEMS THICKER.  LET ME DEMONSTRATE THIS BY PLAYING
2 EXAMPLES.
LISTEN TO EXAMPLE #9 ON TAPE 3. NOTE HOW EACH INSTRUMENTAL
LINE HAS A UNIQUE SOUND QUALITY. THE TEXTURE IS THIN.
(TYPE GO WHEN YOU HAVE FINISHED)
? GO

NOW, LISTEN TO EXAMPLE #10 ON TAPE 3. THE SOUND QUALITY OF
THE VARIOUS INST. ARE CLOSER THAN IN EX. 9. DO YOU THINK
THAT THE TEXTURE IS THICKER AS WELL?
? NO


THE TEXTURE IN THIS MUSIC IS 'THICKER' THAN IN THE OTHER EXAMPLE.


QUES. NO. 7
TO SUMMARIZE, LET US SEE IF YOU CAN RECALL SOME OF THE
FEATURES THAT WE HAVE BEEN DISCUSSING   (I TRUST THAT YOU
 WON'T LOOK BACK).
ONE FEATURE CLOSELY RELATED TO SOUND QUALITY IS ............
? TEXTURE


WHY, OF COURSE


QUES. NO. 8
PLEASE MATCH THE FEATURES ON THE LEFT WITH THE STATEMENTS ON
THE RIGHT.

    A. SPACE AND DIRECTION.          1. THE MUSIC SUDDENLY SLOWS DOWN
    B. CONTRAST                      2. PLAYED IN A CHURCH WITH
                                        TRUMPETS PLACED ON BOTH SIDES
                                        OF THE APSE.
    C. TIME OF DAY                   3. MUCH TRIBAL MUSIC BEGINS AT
                                        HIGH PITCH AND MOVES DOWNWARD
                                        UNTIL EXHAUSTION.
    D. REPITITION                    4. INDIAN RAGA; POSSIBLY A
                                        MOZART SERENADE.
    E. TEMPO CHANGE                  5. PHRASE ONE IS BRIGHT WITH A
                                        RAPID TEMPO. PHRASE TWO IS
                                        SLOW IN TEMPO AND VERY SOFT.
    F. MELODIC SHAPE                 6. A MOTIVE IS REITERATED MANY TIMES.

 (TYPE ONLY THE LETTER WITH THE ASSOCIATED NUMBER.
                   IE.,   A3 B1 F2   ETC.)
? A3 B4 C2 D6 E5 F1


I WOULD MATCH THEM AS FOLLOWS, STUDENT.
        A2 B5 C4 D6 E1 F3

QUES. NO. 9

    1        1        0        0
    1        1        2

WE HAVE ALREADY DISCUSSED A NUMBER OF FEATURES AND THEIR USAGES.
LIST 5 FEATURES.   (REMEMBER THAT YOU MUST TYPE 1 LINE ONLY)
        (FOR EXAMPLE - MELODIC SHAPE, ETC)

? TEXTURE RYTHMNS PITCH TIMBRE CULTURAL STYLES


NOW LIST ANOTHER 5 FEATURES.
        (FOR EXAMPLE - MELODIC SHAPE, ETC)

? SOUND QUALITY  DON'T KNOW ANY MORE


YOU WERE ABLE TO RECOLLECT  5 FEATURES
LET ME GIVE YOU SOME HINTS  - MAYBE YOU WILL DISCOVER MORE FEATURES.
        2 FEATURES DEAL WITH  DURATION AND TIME
        2 FEATURES DEAL WITH  THE NATURE OF SOUNDS.
        2 FEATURES DEAL WITH  HORIZONTAL AND VERTICAL PITCH ORGANISATION
NOW LIST ANOTHER 5 FEATURES.
        (FOR EXAMPLE - MELODIC SHAPE, ETC)

? DOUBLE AND TRIPLE TIME ,HARMONY,


TO REFRESH YOUR MEMORY, I'LL LIST WHAT I BELEIVE ARE THE
ESSENTIAL FEATURES IN MUSIC.


    1. TECHNIQUES OF REPITITION (SEQUENCING)
    2. USE OF CONTRAST (MOTIVE, PHRASE, MELOD.)
    3. RHYTHMIC PATTERNS
    4. TONAL RELATIONSHIPS
    5. TEXTURAL CHANGE
    6. USE OF DYNAMICS
    7. SUBJECTIVE FACTORS (AGITATION, REPOSE , JOY, ETC)
    8. MELODIC SHAPE
    9. SOUND QUALITY /TIMBRE
    10. VERTICAL ORGANISATION OF SOUNDS (HARMONY)
    11. ORGANISATION OF SOUNDS IN TIME - METER, TEMPO
    12. SOUND SPACE, DIRECTION OF SOUNDS
    13. (MAYBE YOU HAVE THOUGHT OF OTHERS)

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QUES. NO. 9
```
        1        1        0        0
        1        1        2
```
WE HAVE ALREADY DISCUSSED A NUMBER OF FEATURES AND THEIR USAGES.
LIST 5 FEATURES.  (REMEMBER THAT YOU MUST TYPE 1 LINE ONLY)
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        9. SOUND QUALITY /TIMBRE
        10. VERTICAL ORGANISATION OF SOUNDS (HARMONY)
        11. ORGANISATION OF SOUNDS IN TIME - METER, TEMPO
        12. SOUND SPACE, DIRECTION OF SOUNDS
        13. (MAYBE YOU HAVE THOUGHT OF OTHERS)

WHEN YOU ARE READY, TYPE GO.
? GO


WE HAVE COMPLETED THE 1ST SECTION OF THE LESSON.
LET'S SEE HOW YOU 'VE BIN DOIN.
YOU ARE DOING FAIRLY WELL. YOU ONLY HAD PROBLEMS WITH ONE
OR TWO QUESTIONS.


WE HAVE TRIED TO FAMILIARISE YOU WITH THE VARIOUS FEATURES IN
MUSIC AND THE WAYS IN WHICH THEY ARE USED.


    WOULD YOU SAY THAT THIS IS -
            1. VERY IMPORTANT TOWARDS THE STUDY OF MUSICAL STYLE?
            2. OF SOME IMPORTANCE?
            3. NOT RELEVANT?

        (PLEASE TYPE 1 2 OR 3)
? 2
WHAT ARE YOUR IMPRESSIONS OF THIS LESSON SO FAR?
PLEASE INCLUDE ANY SUGGESTIONS YOU MAY HAVE FOR LESSON IMPROVEMENT.
(THIS MAY TAKE A FEW LINES. THEREFORE, AT THE END OF A LINE,
PRESS THE RETURN KEY; THEN, TYPE ANOTHER LINE.
WHEN YOU ARE THROUGH , TYPE FINISH.

? INTERESTING. I DON'T THINK THAT THIS METHOD OF LEARNING WOULD

? WORK FOR ALL ASPECTS OF MUSIC, SUCH AS PRACTICE, BUT IT WORKS

? QUITE WELL FOR THE STUDY OF BSSIC THEORY OF MUSIC

? FINISH.

? FINISH


PLEASE TEAR OUT YOUR SUGGESTIONS AND PUT IN ENVELOPE.
NOW LET US GO ON WITH THE NEXT SECTION.


IF YOU NEED A BREAK, PLEASE TYPE SHALT (WAIT FOR MESSAGE,
 AND TYPE BYE). OTHERWISE TYPE CONTINUE.
?


    SHALT

CITCAN USER TERMINATION

# APPENDIX G

## STUDENT EVALUATION FORM

1. Attitude towards the CAI program.   (From terminal output).

___   _____   _____   _____   _____
Neg.   Slightly Neg.   No Opinion   Slightly Pos.   Positive

2. Intrinsic interest:

Are you   Very   Slightly   not   interested in the subject
of musical style?

3. Anxiety level of students in interacting with the computer (from
terminal output).

_____   _____   _____   _____
timed-out   >8 mis-types   log on diff.   commands diff.

4. Plays the following instrument:

Piano _____   Years _____

Guitar _____   _____

Drums _____   _____

Flute _____   _____

Sax _____   _____

Synth. _____   _____

Other:  specify _____

5. Was the instructional material -

        Too difficult    _____

        Just right     _____

        Too easy     _____

6. Were there   too many  _____     review exercises?

                enough    _____

                too few  \_\_\_\_\_

7. Was the CAI lesson:

        too long  _____

        too short  _____

        just right in length  _____

8. Was there   too much  _____     student control?

                enough   _____

                too little  _____

9. What improvements would you suggest?

_____

_____

_____