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The use of computers in music education in South West Africa

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2014-08-18
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It is noted that it is not necessary to include all the available rhythm patterns in one exercise.

3.4.3 VALIDATION OF THE CAMETS SYLLABUS

It is noted that the CAMETS syllabus was formulated by the researcher using the appropriate sections of the UNISA syllabus as a model. Validation of the CAMETS syllabus was undertaken by requesting its evaluation by experts in this field. A comprehensive fifty-page document detailing all the relevant information regarding this study was sent to fourteen highly qualified music lecturers at six universities throughout the RSA. This document included the UNISA syllabus, the CAMETS syllabus and tests as well, as questionnaire. These experts were requested to consider the CAMETS syllabus in terms of the UNISA syllabus in determining the extent of congruence between the two. Responses to this questionnaire are described in Chapter 8.

3.5 CHOOSING THE APPARATUS FOR COMPUTER-ASSISTED INSTRUCTION

Since the inception of the idea for the current study in February 1982, it was the intention of this researcher to focus the research primarily on determining the effectiveness of an existing computer-assisted music education system. At that time, this researcher ascertained that two such systems were available which would suit the purposes of the study. These were the AlphaSyntauri Music Education System and the Micro GUIDO Ear Training System. An initial attempt to obtain the former system was not successful because the advertised date of release for the relevant software had not been met. As far as Alpha Syntauri was concerned, intended purchase was con-

sidered a low-priority item and no maintenance would be offered. Thereafter, it was ascertained that an alternative system, Music Tutor, marketed by Apple Inc., was available. However, it appeared that this program was too simplistic and limited in scope for the purposes of this research. Finally, a decision was made in June 1983 to acquire the Micro GUIDO Ear Training System from Control Data, RSA. It later became apparent that this system, which was part of the PLATO educational project, was by far the most comprehensive system commercially available in music aural training. Concurrence of this view is evident in research by Watanabe (1981), Newcomb (1983), Gaede (1982) and Hofstetter, the developer of the GUIDO system (1975). Furthermore, the GUIDO system, which was initially developed for use on a mainframe computer, was only made available for use on a microcomputer in January 1983. The system purchased for use in this study in October 1983 was the first of its kind to be imported into South Africa.

It is noted that this system was purchased at the expense of the researcher at a cost of R8 850.00 The price was approximately twice that of the other systems initially considered.

4.0 METHODOLOGY

The methodology used in the present study incorporated both quantitative (the controlled experiment) and qualitative methods (observation, questionnaires and interviews).

4.1 QUANTITATIVE METHOD

Experimentation in social research is regarded as an acceptable method of attempting to demonstrate the existence of a causal relationship between independent and dependent variables (Bailey 1978, pp. 222-223). Although it is debatable whether or not the existence of a causal link between variables can actually be empirically demonstrated or proved, the logic of experimentation is based on the premise that it <u>is</u> possible to establish causality.

The researcher attempts to establish causality by proposing a causal hypothesis which states that the independent variable causes change in the dependent or effect variable. Thereafter, the researcher measures the dependent variable (pre-test), introduces the independent variable (treatment) and finally remeasures the dependent variable (post-test) to see whether there has been resultant change in its value. The degree of certainty with which changes in the before and after measures of the dependent variable may be attributed to the test stimulus depends on the 'degree of closure' obtained by the researcher in the experiment. Degree of closure is defined as the extent to which the investigator can control the relevant variables or the variables assumed to be relevant (Bailey 1978, p. 226).

In an ideal experiment the researcher exercises four forms of control, namely; a) control of the composition of experimental and control groups; b) control over the independent or causal variable; c) control over the test apparatus and level of measurement necessary to measure

the values of the dependent variable; and d) control over the environment in which the experiment is conducted.

Hypotheses 1 and 3 were proposed to determine the relative efficacy of CAI and traditional instruction. This experimental study examined the relationship between the degree of skill proficiency obtained by students in specific aural-perception tasks (the dependent variable) and the type of instruction administered to students, namely, CAI and the conventional method of group-class instruction (the independent variable). This was achieved by exposing students to the above-mentioned methods of instruction. Differences between student achievement scores on a pre- and post-treatment test in ear training were compared to determine whether or not the computer-assisted ear training program was more effective than the traditional method of instruction.

In addition, Hypothesis 2 was proposed to examine differences in the degree of skill proficiency obtained by students receiving CAI, among students of different sex, age group and extent of music theory knowledge. The three hypotheses have been previously stated and the relevant variables identified (q.v. Ch. 1.4).

4.2 THE INNOVATORY PROGRAMME

For the purpose of this study, it was decided to limit the field of inquiry to only two aspects of music ear training: interval recognition and rhythm dictation. The reason for this choice was that pitch and rhythm are considered to be the fundamental parameters[33]

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[33] Parameters: although specifically referring to a mathematical term denoting special variables, this term has been introduced in music to indicate variables of pitch, rhythm, volume, timbre, etc., (Apel 1970, p. 642).

of music[34]. Other parameters (such as melody and harmony) are extensions of the basic parameters of pitch and rhythm. Music educators agree that it is necessary to consider these components of music (pitch, rhythm, melody, harmony and timbre) separately in the study of music (Ben-Tovim 1979, pp. 102- 105; Copland 1957, pp. 31-67) before perception and appreciation of the whole is achieved. Furthermore, the choice of these two parameters was made because most of the students participating in this study were at a primary and secondary level of music development. Therefore intervals (the discrimination between two pitches) and rhythm was an appropriate choice, as most of these students would have already encountered these components in music and would have the theoretical knowledge of music necessary to understand the concepts of intervals and rhythms.

4.3 CHOOSING THE SAMPLE

The population under investigation in the present study was designated as school-going students attending the Windhoek Conservatoire, Windhoek, SWA. Due to the size of this population the researcher chose to limit the sampling frame to students between the ages of eleven and fifteen years. This decision to limit the sampling frame was made for practical reasons, namely, that only one computer was available for the study, and the designated sampling frame provided an adequate number of students of different ages within this frame for a comparative study within particular age groups. Furthermore, the adequacy and representativeness of a sample chosen from this reduced sampling frame would be ensured. Justification of the representativeness of the chosen sample has previously been given (q.v. Ch. 1.4.6). A random sampling procedure was used to select the

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[34] Cassiodorus (c. 485 - c. 580) adopted Plato's distinction between scientia harmonica (high and low sounds), metrica (different meters) and rhythmica (relation to text) (Apel 1970, p.548).

sample from the designated sampling frame. Detailed procedures regarding sample selection are presented in Chapter 5.3.

Any research study using a relatively small sample is limited to certain kinds of statistical analysis. Obviously, stronger inferences about the population under study are possible with larger samples and greater external validity is more likely than when a small sample is used.

4.4 MATCHING

The researcher chose to use the method of randomised blocks in the design of the comparative study, that is, students are 'paired' according to some predetermined criterion variable and then each separate pair is assigned to the experimental or control group at random. This matched-pair technique provided a means of controlling for initial level of the dependent variable. Participants in the study were at different initial levels of achievement in music ear training, that is, at different grades. To ensure the comparability of experimental and control groups, it was considered imperative that the groups be structured according to initial pre-test scores at a particular grade level. Furthermore, this technique provided for control of various extraneous variables, namely, history, maturation, selection, attrition and statistical regression. These variable are defined later. Detailed matching procedures are given in Chapter 5.

4.5 DESIGN OF THE EXPERIMENT

A modified pre-test/post-test control group design was used in this study. This true experimental design provided adequate controls for sources of internal validity. After 'block' pairing on pre-test scores had been established, one student from each pair was randomly

assigned to either the experimental or the control group. The experimental group received CAI, while the control group received traditional group-class instruction.

It is usual for treatment to be withheld from the control group in the pre-test/post-test control group design. The design employed in the present study was modified in this respect, namely, that treatment was received by both groups in separate aspects of music ear training: interval recognition and rhythm dictation. The assignment of students to experimental and control groups outlined above was made in one aspect of ear training, viz. interval recognition. Scores obtained by students on the interval recognition section of the pre-test were used as a basis for defining these groups. Therefore, each student was either part of the experimental group (CAI) in interval recognition or part of the control group (traditional instruction) in interval recognition.

In order to control for the Hawthorne or novelty effect (see 4.7 below), it was decided that all students in the sample should receive CAI. It would have been possible to achieve this by providing an 'irrelevant' CAI learning experience for the control group. A precedent for this exists in a study by Ford (1984) in which the control group received CAI in word-processing. This was acceptable because the treatment administered to the control group was distinct from, and not related to, the treatment received by the experimental group. The researcher wishes to argue that it is equally feasible to administer a 'relevant' treatment to the control group, that is, one related to music ear training, provided that this treatment comprises an independent category of music education. It would not have been feasible to administer CAI in melodic dictation to the control group, for example, since melodies comprise a series of intervals. A student's ability to recognise intervals is likely to positively influence his/her ability to notate a melody. It was therefore decided that the control group would receive CAI in rhythm dictation, since rhythm and pitch (intervals) comprise separate categories of music.

Sample selected at random (N = 43)

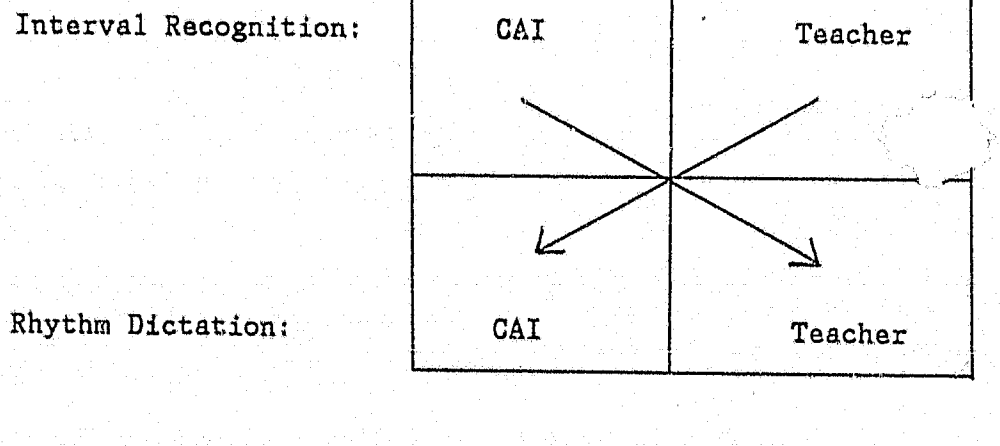

Figure 7. Schematic display of CAMETS research design: note - pairing was made on interval recognition scores of pre-test and subjects were randomly assigned to experimental or control group. Thereafter, pairing was established on rhythm dictation scores for consideration in the appropriate statistical test.

Modification to the standard experimental design was made by allowing the pre-defined control group in interval recognition to simultaneously receive CAI in rhythm dictation. Therefore, an inverse assignment of the original groups was made, in that the intact predetermined control group now became an experimental group (receiving CAI in rhythm dictation), while the pre-defined experimental group was treated as its control, by simultaneously receiving group-class instruction in rhythm dictation. Therefore, students allocated to the experimental group in interval recognition received group-class instruction in rhythm dictation. Similarly, students assigned to the experimental group in rhythm dictation received

group-class instruction in interval recognition. This design is schematically indicated in Figure 7.

It is noted that this research design was conceived by the researcher primarily as a means of negating the Hawthorne effect while adequately controlling as many other control variables as possible. However, it was subsequently learned that another study, not involved with music, had employed a similar design to that of the present study, in a comparison of CAI and traditional instruction. Perkins (1985) conducted a study to determine whether teaching critical thinking skills with the microcomputer produces a greater increase in the thinking skills of middle school students than teaching critical thinking skills with conventional methods, namely the group-class lecture method of instruction. This was achieved by dividing the material to be learned into four modules. Both treatment groups were alternately taught two of the learning modules with the aid of the microcomputer, and two of the modules by conventional methods. An additional control group did not receive any form of instruction. Since the modules comprised independent categories of instruction in critical thinking skills, it was possible to attribute any increase in proficiency of these skills to the particular method of instruction.

The CAMETS tests

The instrumentation used in this comparative study was developed by the researcher as a tool for evaluation of student improvement in music aural skills. Although a number of standardised tests are currently available, none of these were deemed to be suitable for the purposes of this study. Standardisation implies a body of knowledge and skill that all musically educated students should possess (Colwell 1970, p.143). A standardised test is one in which reliability and validity have been ascertained on a national scale. Very few of these tests have applicability and relevance to the context of music education in SWA. Published tests of musical aptitude, talent, achievement and ability were considered to be inappropriate, as were tests of aural-visual discrimination skills. The Aliferis Music Achievement Test (1954), used by Vaughn (1978) in a study sim-

ilar to the present research, was unsuitable because this test is intended to measure auditory- visual discrimination ability and is primarily intended for use at the college entrance level.

It was therefore decided to construct tests which correspond exactly with the CAMETS syllabus and which examine proficiency in interval recognition and rhythm dictation in the precise manner in which questions are presented on the GUIDO system.

The eight CAMETS Grade tests in Interval Recognition and Rhythm Dictation (Grades 1-8), as well as CAMETS grade test papers and instructions for the examiner administering the tests are given in Appendix F.

4.5.1 PROCEDURES FOR VALIDATION OF THE CAMETS TESTS

It was beyond the scope of the present study to attempt the standardisation of the CAMETS tests. Yet it was realised that the validity and reliability of these tests was crucial to the present study. After all, if the testing apparatus was flawed, any results indicating student improvement would be questionable and the entire raison d'être of the study invalidated.

Obviously, every effort was made to ensure concordance between the CAMETS tests nd syllabus. Face validations of the tests were made by experts at six universities in the RSA. Reliability or consistency of test scores was ascertained using the procedure of test-retest reliability. Participants in the comparative study were requested to take the test again, four months after the study had been completed. Concurrent validity (defined previously) was established by comparing the results of students not in the sample with their results on the appropriate sections of concurrent UNISA examinations. Results of these procedures, as well as interviews with group-class instructors and participants in the concurrent validity sample, are presented in Chapter 8.

4.6 CHOOSING THE APPROPRIATE STATISTICAL TESTS

The rationale for choice of the statistical tests used in this study was based on the nature of the defined population (students attending the Windhoek Conservatoire between the ages of eleven and fifteen), the size of the sample (forty-three students) and the manner of sampling (method of randomised blocks). Furthermore, the measurement requirement was a fundamental consideration.

Parametric tests (such as t or F tests) are considered to be more powerful than nonparametric tests, provided that all conditions of a particular statistical model are met (Siegel 1956, p. 19). A statistical test is only valid under certain conditions, that is, its conditions must be satisfied before any confidence can be placed in any probability statement obtained by its employment. Furthermore, the model and the measurement requirement specify these conditions.

The decision to use nonparametric statistical tests in the present study was made primarily because of the level of measurement available from the researcher-built CAMETS tests. Researchers in education often overlook the fact that measurement devices used in the data-gathering process usually provide a relatively crude index of change in the variable under consideration. In a test of aural-perception ability it may seem that scores would indicate a precise level of proficiency. After all, in this instance, the answer given on a test item would appear to indicate whether or not the student was able to identify the interval or rhythm correctly. It may be argued, for example, that a test in aural ability is likely to yield scores which are more exact indications of proficiency than tests of musical talent or aptitude, which are more predictive measures.

Scores in the CAMETS tests are expressed as percentages, in terms of the number of items answered correctly out of the total number of questions, in each section of the test - interval recognition and rhythm dictation. Siegel has observed that, in scaling, the social scientist often overlooks a fundamental fact in measurement theory,

namely, that in order to be able to make certain operations with numbers that have been assigned to observations, the structure of the method used of assigning scores to observations "must be isomorphic to some numerical structure which includes these operations" (1956, p. 22). Therefore, although it was accepted that the CAMETS tests would indicate proficiency levels in particular aural skills, the percentages assigned to student scores could not be assumed to have reached the level of measurement of an interval scale. The distance of so many per cent could not be considered a relative constant at any point on the scale where it occurred.

Since the comparative study was primarily concerned with student improvement, it would appear that the size of improvement is of paramount importance. Yet, because of the limitations of the present study and the absence of suitable norm-referenced instrumentation, it was only possible to gauge relative improvement among participating students from the CAMETS test results. Student scores could be ordered according to the relative size of an increase between pre- and post-tests.

It is argued that within-pair differences between matched pairs at any grade level could be ranked in order of size of this difference irrespective of the grade level of the pair. It may seem illogical to assume that a between-pair difference of twenty per cent at a grade 8 level is smaller than a between-pair difference of forty per cent at a grade 4 level. However, it is the dimension of improvement that is being considered in this research and not the differences between students at different grade levels. Since matching was established according to initial level of proficiency, the size of a within-pair difference represented the dimension of the improvement of one student over his matched pair. Relative rankings could be established within p. at different grade levels, because within-pair differences represent achievement of students from the same starting point of a particular student's ability. The level of measurement attained in the comparative study was therefore ordinal. Differences between student scores on the CAMETS tests could be interpreted in terms of their direction and relative size to changes in scores of other students.

Since ordinal measurement was only possible in this comparative study, nonparametric tests were used to interpret data obtained from the CAMETS tests. The specific tests chosen were the Sign Test to establish the direction of the differences within pairs exposed to the alternate forms of instruction (CAI and group- class); the Wilcoxon Matched-Pairs Signed-Ranks Test to determine the relative magnitude of within-pair differences at a particular grade level; the Mann-Whitney U Test to determine differences between the groups, considered independently, one grade level at a time; the Mann-Whitney U Test to determine differences in student improvement using only CAI when factors such as age, sex and presence/absence of music theory knowledge are considered separately; finally, the X^2 Test for Two Independent Groups was used to determine whether student achievement levels were attained in terms of predetermined cut-off scores.

4.7 DEGREE OF CLOSURE: CONTROL OF VARIABLES

From the methodology presented above it is evident that the researcher has exercised three forms of control in the experimental design, namely, control of the composition of groups, control of the independent variable, and control of the test apparatus and level of measurement necessary to measure the values of the dependent variable. In a longitudinal study in social research it is not possible for a researcher to exercise complete control over the environment in which the experiment is conducted. Although complete closure cannot be attained, the researcher must strive for some degree of closure by attempting to control all variables that may affect the relationship between the specified cause-and-effect variables.

The methodology adopted in the above research design was specifically tailored to control as many variables as possible with the intention of providing meaningful data for statistical analysis.

1. Hawthorne effect

This has been defined as "an improvement in performance consequent upon participation in an experiment and independent of other factors. It is presumed to be mediated by motivational changes" (Experiment in Educational Research 1973, p. 44 quoted from Downing and Jones in Downing 1967). The Hawthorne effect has been controlled, since each student participating in this study was part of an experimental (CAI) group (either intervals or rhythms). Also, students were not aware of what was actually being tested - intervals or rhythms or both. Because each student worked with the computer it was assumed that any enthusiasm engendered by this educational innovation would be equally spread among the individuals in the sample.

2. History

When instructional treatments extend over a period of time, it is possible that other events occur which may account for end-of-instruction results. This design, based on the method of randomised blocks, allowed for this phenomenon, since there was an equal likelihood of external factors affecting student performance to the same extent. It will be shown later that the majority of students participating in this study did not receive instruction in interval recognition and rhythm dictation from an independent source during the research study period (this information was obtained through questionnaires administered to students). Participating students indicated the frequency of aural instruction in their weekly practical music lessons in this student questionnaire.

3. Maturation

While an instructional treatment is in progress, there may be natural growth occurring in the learners (biological, psychological or sociological) which is more instrumental than the instructional treatment in producing desired results. This design, based on the method of randomised blocks, takes cognizance of this, since it is the between-pair differences that are observed and subjected to statistical analysis. It is assumed that there

is likely to be equal maturation between each pair of students and the effect of maturation is therefore minimised.

4. Testing

Students who take the same test twice, as in a pre-test/post-test design, sometimes perform differently on the post-test as a result of their having taken the pre-test. It was assumed that, in all probability, this effect would influence both experimental and control groups equally. Also, it will be shown later that it was necessary to administer a second pre-test at a higher grade level. It can be argued that the 'testing effect' would have had an influence on these second pre-test scores, but it is observed that this influence would have been equal amongst individuals in the sample. Furthermore, if some students were perhaps overwhelmed at the prospect of taking a written ear-test (as might well be expected, since the majority had never taken such a test previously), their achievement scores on the second pre-test were likely to have stabilised to give a better reflection of their competence, despite having become 'test-wise'.

5. Instrumentation

If the measuring instruments are changed during an evaluation study, any apparent changes in student performance might be more directly associated with the shift in measuring devices than with the educational phenomenon being evaluated. It is noted that both pre-tests and post-tests administered were identical, and that the method of marking test-papers was pre-determined and strictly adhered to in awarding marks on both tests. Therefore instrumentation was identical in all respects, both before and after treatment, and therefore controlled.

6. Memory

From a small pilot study it was ascertained that memory has no effect in an ear-test, that is to say, a student taking an ear-test is unable to recall his/her answers if the same test is

administered shortly thereafter. Five students (not in the sample) were given the CAMETS test at the appropriate grade. These students were all aged between eleven and fifteen years. Two students had perfect pitch. Despite this, none of these students were able to remember their answers when the identical test was re-administered a week later. In the interval recognition section, pitch retention proved to be impossible, and even the sequence of answers given in the first test was not recognised in the second test. In the rhythm dictation section, one student "seemed to recall" a portion of one of the rhythms played, but could not be sure. In any event, all five students stated that it was obviously preferable to "rework out" the answers rather than rely on memory. It is noted that the administration of the pre- and post-tests were separated by a period of six months.

7. Instability

Most measures used in evaluation investigations are less than perfectly reliable. It is acknowledged that the CAMETS tests are not standardised, but that some attempt was made to determine the reliability and validity of the tests. This is fully notated in Chapter 8. It is sufficient to point out that a test-retest reliability check resulted in a high correlation of scores (r = .85 and .83 on the respective sections of the CAMETS tests).

8. Selection

In evaluation studies where performance of two or more groups is being analysed, the effect of an educational intervention can be confounded if the students constituting the groups are selected differently. Since individuals were randomly selected initially for participation in this study, and because the method of randomised blocks was used to determine the experimental and control groups, this effect was assumed to be controlled.

9. Attrition

If two groups are involved in an evaluation study and pupils drop out of one of the groups differentially, the results of the study may be confounded. It is noted that only two of the forty-five students did not complete the treatment in this study and were therefore dropped from the research data. Also, since each had a matched counterpart, these scores could no longer be considered in isolation and the effect of attrition was therefore controlled.

11). Statistical regression

The principle of 'regression towards the mean' holds when a comparison of tests (pre- and post-) is made, even when the same test is used. There is a tendency for students at the extreme ends of a distribution (i.e., those achieving very low or very high scores on a test) to regress towards the mean on a subsequent test "irrespective of the kind of treatment, if any applied" (Experiment in Education Research 1973, p. 16). Since this study was based on the method of randomised blocks, this effect is assumed to have equal influence on the experimental and control groups.

Therefore, it is argued that any significant change between pre- and post- test scores could be directly attributed to the method of instruction.

4.8 QUALITATIVE METHODOLOGY

In addition to the above quantitative methodology, certain qualitative methods were used to further inform the experimental study, by providing additional information which might assist in the interpretation of the measurement data obtained. The qualitative methods used were questionnaires, interviews and observation. These have been previously outlined in Chapter 1.4.8 and are fully described and presented in Chapter 7.

5.0 DESIGN OF THE COMPARATIVE STUDY

This chapter presents a detailed description of procedures for selecting subjects, selection of experimental and control groups and matching used between groups. Thereafter, details regarding the implementation of the research design for the comparative study are presented, treatment is defined and additional variables under control are identified. Procedures for administering the pre-tests are noted, as are descriptive procedures of treatment for subjects in both experimental and control groups. Monitoring procedures of student attendance and progress are given, as well as procedures for administering post-tests.

5.1 SUBJECTS

Subjects were forty-three students aged between eleven and fifteen years, currently enrolled at the Windhoek Conservatoire, SWA, who volunteered to participate in this study. It was assumed that, since the Windhoek Conservatoire accepts a wide spectrum of students (i.e., from schools in Windhoek and surrounding areas) who receive instruction in a variety of musical instruments, and since each group comprises students at different levels of musical achievement (from beginner to a grade 8 level), a sample chosen at random of approximately thirty per cent would adequately represent at least that particular population (i.e., students aged between 11 and 15 attending the Windhoek Conservatoire).

5.2 THE TASK

The material to be learned consisted of a series of hierarchically structured drill-and-practice lessons in interval recognition and rhythm dictation, extending from an elementary beginner's level to a grade 8 level, measured according to UNISA Practical Musicianship requirements for grade examinations. This lesson content was presented to different sections of the sample (detailed below) in two formats: a) using the reconfigured Micro GUIDO Ear Training System, and b) by two qualified instructors in music ear training.

The syllabus in interval recognition and rhythm dictation for group classes (i.e., instruction by music teacher) was identical to that of the computer-assisted music instruction program. These syllabi have previously been presented in Chapter 3.4.

5.3 SAMPLING PROCEDURE

It was first established that, as at 15 March 1985, there were 260 students between the ages of five and eighteen years registered at the Windhoek Conservatoire. This was ascertained from an examination of registration files prior to the research period. Although confidential, this information was obtained by the researcher with permission from Dr P. Roos, Head of the Windhoek Conservatoire. Adult students enrolled at the Conservatoire were excluded in this tally and were not considered for participation in the project. It was decided to limit students for participation in this study to those between the ages of eleven and fifteen years. The registration figures as at 15 March 1985 are given in Table 1.

Thereafter, ninety of these students (age 11-15) were selected at random, using a table of Random Numbers (Tuckman 1978, pp. 441-442). Letters were sent to these ninety students explaining the nature of requested participation, length of the project (six months), location

(Windhoek Conservatoire), frequency of participation (two half-hour periods twice a week at student's convenience), that participation was voluntary and free of charge. Further, acknowledgement that this study had been authorised by the Directorate Education, Windhoek, SWA was made and the letter was printed on the official letterhead of the Windhoek Conservatoire.

In addition, students were informed in the letter that, once they agreed to take part in the project, they were not permitted to withdraw until the end of the research period. An application form was enclosed, together with a self-addressed, stamped envelope and consent of the parent was requested. At the same time, a letter was sent to parents of all students selected, under separate cover, explaining the nature of the CAMETS project and requesting that parents encourage their children to participate. This letter was supported by a covering letter from Dr P. Roos.

All of the above letters were translated into Afrikaans and German. The appropriate version was sent to students and parents in their home language (the letters referred to are given in Appendix J).

Finally, a letter was sent to all music lecturers at the Windhoek Conservatoire, explaining the nature of the research. A list of the ninety students selected was appended, and lecturers were urged to encourage their students to take part in the study. Lecturers were also informed that they would be invited to attend a demonstration of the GUIDO system at the end of the research period. This letter was supported by a letter from Dr P. Roos, under the same cover.

Of the ninety letters sent out, there was a positive response from forty-five students. All who volunteered were accepted for participation in the project. These students are identified in Table 2.

It is possible to argue that, since the researcher urged parents and teachers to encourage their children/students to participate, this may constitute or contribute to an 'expectancy effect', that is, the researcher's expectations may affect the results of the experiment. Yet it is pointed out that the researcher encouraged students to

Table 1. Student registration at Windhoek Conservatoire as at 15 March 1985

Age	Number of Students	Sex		Language Group		
		Male	Female	Afr.	Eng.	Ger.
11	29	14	15	10	1	18
12	38	15	23	17	5	16
13	32	18	14	12	2	18
14	25	16	9	10	1	14
15	18	5	13	7	2	9
Total:	142					

participate in order to obtain an adequate sample. Furthermore, the researcher's influence was exercised before selection of the sample and allocation of groups. Precedent studies have shown that a researcher's intervention in the experiment may influence results when one group (usually the experimental group) becomes aware of the experimenter's expectations, that is, after the assignment of individuals to experimental and control groups (Rosenthal 1966, Rosenthal and Jacobson 1966, Friedman 1967).

It could be argued that the sample was selected differentially, since students volunteered for participation in the study. It is reasonable to assume that the study might attract motivated students, that is, students who were prepared to become involved in an additional, time-consuming extramural activity. It is reasonable to assume that a less motivated or disinterested student would not volunteer to participate in such a project. However, it is pointed out that the students constituting the experimental and control groups were not selected differentially, since the method of randomised blocks was used to determine the composition of these groups. Nevertheless, the researcher must acknowledge the possibility that the chosen sample might be representative of the more motivated students in the population under consideration. Due to practical considerations it was

Table 2. Students chosen to participate in CAMETS project

Age	Number of Students	Sex		Language Group		
		Male	Female	Afr.	Eng.	Ger.
GROUP A : Age 11 - 12 years						
11	10	4	6	3	0	7
12	14	5	9	9	1	4
GROUP B : Age 13 - 15 years						
13	11	9	2	4	0	7
14	4	2	2	2	0	2
15	6	3	3	2	0	4

Note: Language groups are not exact as some students list two languages as 'home language'.

The respective percentages as representative of the population are:

Age	Percentage
11	34.48
12	36.84
13	34.37
14	16.00
15	33.33

In groups the respective percentages are:

Group A (11 - 12 year olds) 35.82%

Group B (13 - 15 year olds) 28.00%

not possible for the researcher to insist on compulsory participation of students selected from the population.

It is pointed out that two students who started the CAMETS project did not complete the course. Therefore the original sample comprised forty-five students. Although small, it is noted that the sample size was determined by practical considerations. Students at the Windhoek Conservatoire attend lessons during the afternoons, after school hours. Since forty-three students were participating in the CAMETS project, and since each student received one half-hour computer lesson per week, it is evident that the computer was in use almost twenty-two hours per week. The size of the sample was therefore in-

tentionally limited because only one computer was available for this study. As it was, computer lessons had to be scheduled for Saturday mornings, in addition to every weekday afternoon.

5.4 MATCHING PROCEDURE

It was decided to incorporate the method of randomised blocks in the research design of the comparative study, i.e., students were 'paired' according to a pre-determined criterion variable, namely, pre-test scores and grade level, and then each separate pair was assigned to the experimental or control group at random. The pre-test consisted of two separate sections, interval recognition and rhythm dictation. Marks were awarded separately for each section of the pre-test. Eight pre-tests were designed, one for each grade level (1-8). It is pointed out that musical development is not dependent on age. Generally speaking, when a student begins learning a musical instrument, he/she works towards the completion of eight graded examinations and it is generally expected that a student will take one year to complete one particular grade. This situation is prevalent at the Windhoek Conservatoire and also at schools and music institutions in the RSA at the primary and secondary levels of music education. Also, most syllabi including UNISA, Royal Schools of Music and Trinity College of Music, London, follow this approach. The age at which students in SWA (and RSA) start music tuition is flexible, since music is not compulsory for school-going students. Students who choose to study the violin or piano may begin at a very early age (5-9 years) while those choosing flute, oboe or guitar are generally accepted at a later stage (9-12 years), for example. Further, young students (e.g., age 5-9) may take two or more years before they are able to do the Grade 1 examination, whereas older students (e.g., age 14-16) may well be able to manage two grade examinations per year. The music syllabi of UNISA, Royal Schools and Trinity College are designed to allow for this: a student need not complete Grade 1 before proceeding to Grade 2, etc.

As a result of this, the students in the sample chosen were at a variety of different achievement levels (grades). The current grade level of each individual in the sample was first established, that is, the student's grade level as at March 1985. This was carried out by first obtaining information of the most recent grade examination passed (if any) by an individual. Therefore a student who had completed Grade 1 in 1984 was considered to be at a grade 2 level and to be working towards the completion of Grade 2 by the end of 1985. The pre-test administered in April 1985 was set at this current grade level for each student. An examination of student scores obtained on this pre-test were predominantly high in both sections, that is, the distribution of student scores was negatively skewed. These test results indicated that most of the students in the sample had mastered their current grade level with regard to aural examinations in interval recognition and rhythm dictation. It is noted that seven students scored one hundred per cent on the section on interval recognition on this initial test, six scored ninety per cent, five scored eighty per cent and altogether twenty-nine students scored sixty per cent or more. Regarding the section on rhythm dictation of this initial test, it is noted that five students scored one hundred per cent, while altogether seventeen students scored sixty per cent or more.

Due to these high initial scores, it would have been impossible to measure student improvement when the same test was administered (at the same grade level) after the treatment period. It was also determined at this stage to modify the tests slightly in certain respects. For example, the number of intervals asked (initially ten) was increased to prevent 'guessing' from influencing student scores to such a high degree (previously, a correct 'guess' on the interval recognition section could increase the total score by ten per cent). Also, some modification of the rhythm dictation section was made to avoid rhythms ending with a triplet, which is both difficult to play and hear correctly.

This revision of the pre-test on the sample resulted in the development of a final pre-test and its administration shortly after the administration of the initial pre-test.

It is noted that block 'pairing' was initially established on the first pre-test. Students were paired according to current grade level and score on the interval recognition section of the first pre- test. For example, Student 4, who scored fifty per cent on the interval section of the Grade 6 test was paired with Student 43, who scored sixty per cent on the interval section of the Grade 6 test. In this instance, the scores were the closest possible at a grade 6 level.

It is acknowledged that the 'pairing' was not exact, that is, two marks at the same grade level that differed by ten per cent were considered to be close enough. However, the grade level was strictly enforced in the pairing process.

5.5 IMPLEMENTATION OF THE RESEARCH DESIGN

Thereafter, the first student of each pair was assigned at random to the experimental (CAI) group - Intervals (at the toss of a coin), or the control (teacher) group - Intervals. His/her match was automatically assigned to the other group. In order to control for certain variables (see Chapters 4.7 and 5.7) it was determined to use an inverse design. Therefore, students assigned to the experimental group - Intervals were automatically assigned to the control group - Rhythms (i.e., the group receiving traditional instruction in Rhythm Dictation). Similarly, students assigned to the control group - Intervals were automatically assigned to the experimental group - Rhythms. Therefore, each student participating in this study was part of an experimental group (either Intervals or Rhythms) and was simultaneously part of a control group (either Intervals or Rhythms). Because of the automatic inverse assignment of groups, it was not possible for any student to be part of the same group parameter (Intervals / Rhythms).

5.6 TREATMENT

Each student participating in this study was required to attend an individual computer lesson of thirty minutes duration once per week. At the same time, the same individual was required to attend a group-class lesson of thirty minutes duration once per week. Treatment was administered for a six-month period.

5.6.1 GROUP CLASSES

Four group classes were held each week and were presented by two specialist lecturers of Music Theory and Aural Training at the Windhoek Conservatoire. Each lecturer presented two classes per week. The group classes were structured according to age. Each lecturer presented a class for students aged between eleven and twelve years, as well as a class for students aged between thirteen and fifteen years. The size of each group class was relatively small (10 to 11 students per group). It has been stated previously that musical development does not depend on age. As a result of this, each age group (11-12 and 13-15) contained students at different levels of musical development. Although it would have been preferable to organise group classes for each different grade level, this was not practically feasible, as each lecturer would have been required to present eight classes per week. Since the lecturers concerned had volunteered to assist in this study, and since each had a full teaching schedule apart from these extra aural group classes, it was not possible to increase the number of group classes. It became apparent that the decision to structure group classes according to age was not problematic, because most students assigned to a particular class were approximately at the same grade level.

5.7 ADDITIONAL VARIABLES UNDER CONTROL

In addition to the control variables presented in the previous chapter, certain other variables were identified and controlled before the implementation of the research design. These are detailed below.

1. Teacher effect

The level of motivation of the teacher may influence results of a comparative study at either extreme. It is noted that two qualified, highly regarded and competent lecturers at the Windhoek Conservatoire agreed to participate in this research project[35]. Half of the students in the 11-12 age group were randomly assigned to each teacher. Similarly, half of the students in the 13-15 age group were randomly assigned to each teacher. Therefore, the 'teacher effect' or influence was evenly spread amongst the students participating in the study. Through periodic observations of group-class lessons, it was later perceived by the researcher that each teacher had a different style

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[35] The two group-class instructors were Mr J Pieterse and Mr P Münch of the Windhoek Conservatoire.

Mr Pieterse is lecturer in harpsichord, theory and ear training and has the following qualifications:

BA Mus - Univ. Stellenbosch;
M Mus - Univ. Pretoria;
KOD - Univ. Stellenbosch;
UOLM - theory and recorder
LTCL - harpsichord

Mr Münch is lecturer in organ, theory and ear training and has the following qualifications:

B Mus (Hons) - Univ. Witwatersrand;
UOLM - organ.

of teaching. Both were highly motivated and extremely accomplished instructors in their field. This high motivation was considered to be advantageous in determining the effectiveness of CAI.

2. Content of CAI lessons and teacher lessons

It is noted that both teachers were required to follow a predetermined syllabus in interval recognition and rhythm dictation and that this syllabus was identical to the CAMETS computer lessons. However, it was left to the discretion of each teacher to determine how lessons should be presented, how much should be presented in one session and in what manner knowledge should be imparted.

3. Time spent in each form of instruction

As stated previously, the length of computer lessons, frequency and length of group-class lessons was held constant (thirty minutes per week in CAI and thirty minutes per week in traditional instruction) and therefore controlled. The study period continued for six months and student attendance of computer lessons and group classes was closely monitored and controlled.

Control of the time spent in each form of instruction was achieved in the following manner. Towards the end of the six-month treatment period, the researcher calculated the number of times each student had attended both CAI sessions and group classes. This information was taken from attendance registers (see below). If a student had attended more computer lessons than group classes, that student was instructed by the researcher to discontinue CAI sessions until the necessary classes had been attended, in order to equalise the time spent in each form of instruction. Similarly, if a student had attended more classes than CAI sessions, the researcher scheduled additional sessions of CAI. It is noted that in most instances students had attended more CAI sessions than classes. In cases where students had to make up many classes, these students were instructed by the

researcher to attend two group =lasses per week, one of each of the relevant classes presented by each group-class instructor.

It should be pointed out that students participating in this study received CAI individually while they were part of a group in the traditional method of instruction. Justification for this apparent lack of concordance between the experimental and control group is made in the light of the reality of the learning milieu of students studying music. It is usual for students to receive instruction in ear training in groups (at the Windhoek Conservatoire and every other music educational institution in SWA and RSA). Precisely because of the nature of the instruction (relying on constant repetition, since it is only drill-and- practice that is used in teaching aural training), it would not be feasible to expect music educators to administer drill-and- practice routines in ear training on an individual basis. It is pointed out that, although some music teachers may include aural training as part of the individual's practical lesson (i.e., on an instrument), this may be considered the exception rather than the norm, certainly at the Windhoek Conservatoire. In any event, the time devoted to aural training in practical lessons is minimal (possibly ten minutes per one-hour lesson per week at most).

It is argued that the two modes of instruction under consideration are fundamentally different by nature, since CAI provides individualised instruction whereas traditional instruction refers to a group-class situation. Indeed, proponents of CAI argue that the ability to provide individualised instruction is precisely the advantage of the computer as an educational tool over the traditional method. Therefore, it is argued that it was the purpose of this comparative study to investigate this inherent difference between CAI and traditional instruction by examining the relationship between the independent variable (type of instruction) and the dependent variable (student skill proficiency in aural perception). The quantitative research methodology and design were implemented in order to be able to argue that all variables were held constant, save one - the type of instruction - so that the relative increase in the dependent variable could be compared. The difference in test scores could be directly attributed to either CAI or traditional instruction and the

relative increase in the dependent variable could be attributed to the causal variable.

5.8 PROCEDURES

Having determined the composition of groups (experimental and control) using the method of randomised blocks, treatment (i.e., CAI and group classes) was begun on 29 April 1985. The initial pre-test (before treatment) had been administered on 25 April 1985, pairing had been established and students had been randomly assigned to experimental and control groups.

It has been noted previously that the results of the initial pre- test were negatively skewed because of the preponderance of high scores. In order to provide a more effective scale on which student improvement could be measured, it was determined to re- examine all students in the sample, using a test at a higher grade level and therefore at an increased level of difficulty. It was decided to re-examine students at a grade level three grades higher than their current level (i.e., their level in 1985). For example, a student currently at a grade 2 level, who had already taken a pre- test at this level, was now required to write a second pre-test at a grade 5 level. The decision to upgrade each student's grade level was initially made primarily to lower student achievement scores so that student skill proficiency could be measured effectively. It would have been impossible to detect an increase in proficiency if a student scored one hundred per cent on the initial pre-test and this same test was administered at the end of the six-month period of treatment. It was hoped that a second pre-test administered at a higher grade level would effectively reduce student starting (pre-) scores and this proved to be the case.

It is evident that, since 'pairing' and randomisation had been established on the initial pre-test scores, some modification would be necessary if a second pre-test was now considered as a basis for de-

termining randomised blocks. Fortunately, this did not prove to be problematic, since the original pairing could be kept in the majority of cases, even though scores on the second pre- test were now used as the basis for this procedure. In a few cases the original pairing had to be scrapped, resulting in a slight modification of the original experimental and control groups. It is noted that in certain instances re-assignment to groups had to be made in any event because of circumstances of individuals in the sample. For example, in the case of siblings it was not always possible to structure experimental and control groups according to pairing and randomisation because it was not convenient for these siblings to attend instruction periods (particularly group classes) at different times. Due to circumstances beyond the researcher's control; it was necessary in some instances to assign siblings to the same group class. Since both were now part of the same control group it was no longer possible to retain the original pairings if one of the siblings had initially been assigned to a different control group. Re- assignment of individuals due to circumstantial considerations was more problematic than the re-assignment on the scores of the second pre-test.

The second pre-test was administered on 27 May 1985. It may reasonably be argued that the effect of treatment (CAI and teacher) would have influenced these scores because almost four weeks of treatment was administered before this second pre-test was given. However, it is noted that the first two weeks of group-class lessons were used to explain the theoretical musical background necessary for the understanding of interval recognition and rhythm dictation. Although it has been stated previously that most of the students in the sample would have already been familiar with these theoretical concepts, the first two weeks of group classes were used to consolidate this knowledge and were primarily directed towards beginners in the classes who would not yet have acquired this knowledge. Similarly, the first two weeks of computer lessons was used to demonstrate to students (individually) how the computer worked and how to answer the music lessons on the computer. Therefore, it is pointed out that students received two or fewer lessons in the different methods of instruction (CAI/teacher) before the second pre-test was administered and it was assumed that these lessons had a negligible effect on achievement

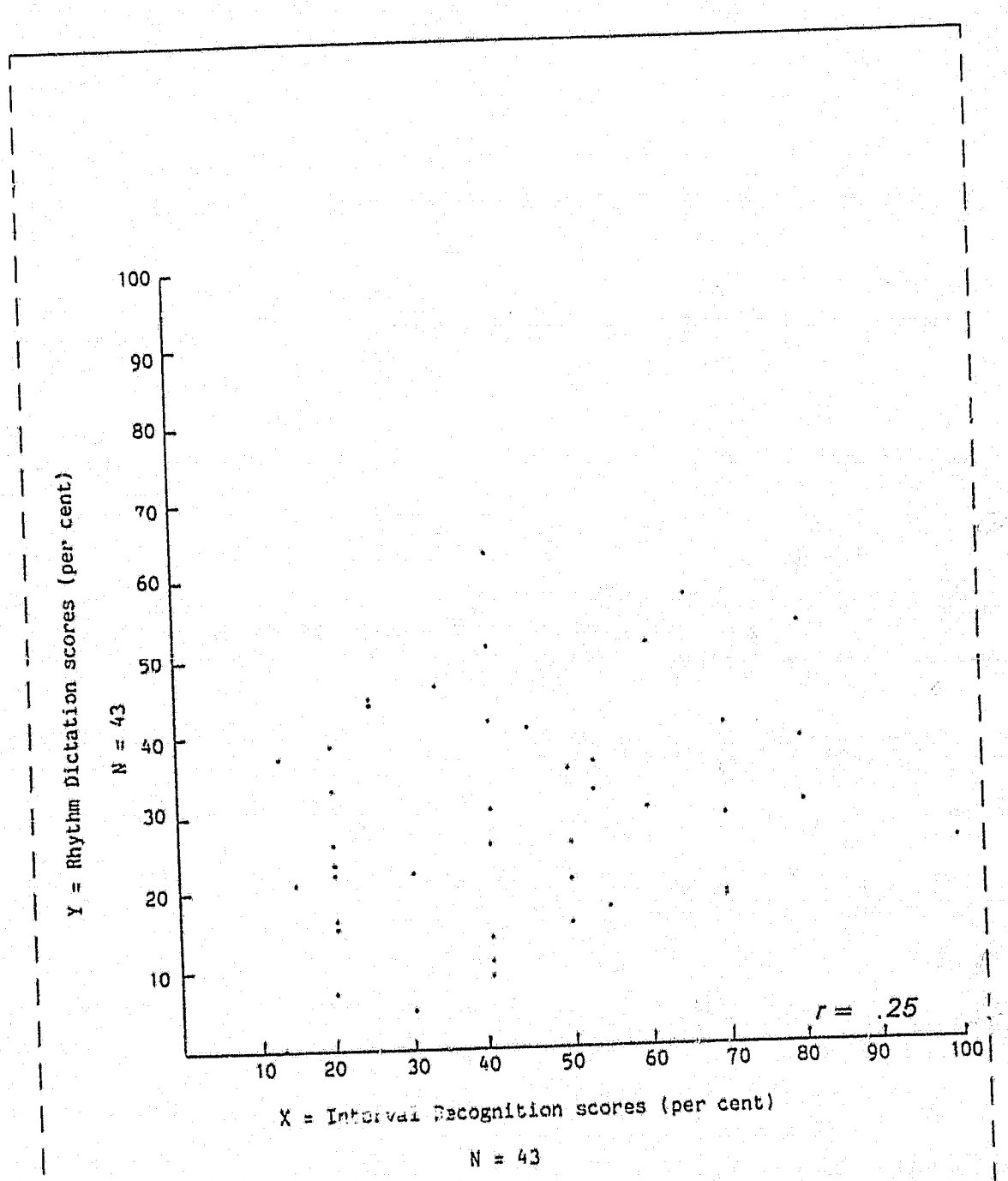


Figure 8. Scatter diagram - Interval and Rhythm scores (pre-test)

scores at this higher grade level. Also, any 'treatment effect' is likely to have influenced these scores to the same extent throughout the sample.

It is pointed out that there was a low correlation between student scores on the interval recognition and rhythm dictation sections of

the second pre-test. This lack of correlation is evident in Figure 8.

It is obvious that th cial pairings, established from scores on the interval recognition section of this test, could not be used as a basis of comparison of scores obtained by students in rhythm dictation. Therefore, students were re-paired according to the closest possible matching on these (rhythm) scores. Each set of pairings would be used in the appropriate statistical analysis to determine differences between groups in interval recognition and rhythm dictation.

5.9 DESCRIPTIVE PROCEDURES OF TREATMENT

5.9.1 COMPUTER-ASSISTED MUSIC INSTRUCTION

1. Student instruction

a. Individual demonstration

During the first week of instruction the researcher spent thirty minutes with each student on the computer. This demonstration included familiarising the student with operating procedures, the use of the particular instructional program (interval recognition or rhythm dictation) assigned to each student, and procedures for recording progress. Each student had to complete a register indicating attendance, date, time and number of units (lessons) completed.

b. Written instructions

Each student was given a nine-page document which detailed all the relevant information necessary for a student to use

the computer and CAMETS program. This instructional material was prepared by the researcher in English, Afrikaans and German. Each student received a copy in his/her home language (see Appendix A).

c. Help-boards

Twelve brightly coloured help-boards were displayed above the computer to aid students. These provided quick references (in English and Afrikaans) to assist students in overcoming the most common problems and procedures in operating the computer (see Appendix K).

d. Follow-up demonstration

During the second week of the CAMETS project, the researcher provided additional assistance and supervision for each student. This session was used to determine whether students were able to operate the CAI system adequately and to answer student queries.

e. Locale

The Micro GUIDO system was housed in the researcher's studio at the Windhoek Conservatoire. Since the researcher is employed as guitar lecturer, and this instruction is administered from this studio, it was necessary to partition the studio. A curtain was used to divide the studio in half. Students involved in the CAMETS project worked with the computer in one half, while the researcher taught guitar in the other half. Although not an ideal arrangement, alternative suitable premises were not available to isolate the students receiving CAI while allowing the researcher to be close at hand to assist these students. Since students using the computer listened to music examples through insulated headphones and had no visual contact with guitar students, it was hoped that this arrangement would prove satisfactory.

f. Continued supervision

This arrangement continued throughout the second school quarter until 26 June 1985. Therefore, the researcher was on the premises during this period to provide assistance. Students requiring assistance would ring a bell. During the third school quarter, the researcher moved to a nearby studio. It was now necessary for students needing assistance to call the researcher. This arrangement continued until 19 September 1985, after which time the researcher moved back to his original premises. This continued until the end of the treatment period (1 November 1985). It is noted that assistance was given to students in overcoming mechanical problems concerning the running of the computer programs. Minimal assistance was given in answering the drill-and-practice lessons, except during the first two sessions of the research period.

2. Monitoring of students

a. Attendance

A register was kept by the researcher monitoring student attendance of individual lessons. It is noted that eighteen weeks of instruction were available during the six-month treatment period. Of the eighteen half-hour periods of CAI administered, the students in the sample attended an average of 16.6 times, ranging from eighteen to fourteen sessions. It must be noted that attendance was influenced by practical considerations, namely, mid-year school holidays, public holidays, extra holidays given to German schools and illness of the participants.

b. Progress

At the end of each computer session, the student was required to record his/her progress by completing a progress register. The student recorded the number of the disk used during that

session, the number of units completed and where to recommence working. The researcher was able to check this information because the GUIDO system keeps a record of units successfully completed, by marking these with an asterisk adjacent to unit titles. The researcher initialled each student entry after checking his/her progress. Thereafter asterisks were deleted from the disk for use by the next student.

c. Anonymity

Each student was assigned an educational code name (such as Bach, Chopin, Mozart, Shakespeare, etc.,) at the beginning of the CAMETS project. Student entries in the attendance and progress register were made under these code names so that students would not be able to compare their progress with friends, nor establish who was the 'best' (most advanced) or weakest in the study.

5.9.2 GROUP-CLASS INSTRUCTION

1. Initial music theory instruction

During the first two weeks of group-class instruction, the lecturers taught the theoretical knowledge necessary for the aural-perception tasks in interval recognition and rhythm dictation. This included the theory of scale construction, interval identification, note values and groupings, and explanation of time signatures. Although most of the students participating in this project already had this theoretical knowledge, the first two group-class periods were intended primarily for beginners in the groups and as reinforcement of theoretical concepts for the more advanced students. It is noted that <u>all</u> students received this theory instruction in <u>both</u> parameters (interval recognition and rhythm dictation), irrespective of which control group each

had been assigned to, either the interval recognition class or the rhythm dictation class.

2. Monitoring of students

a. Attendance

Each lecturer kept a register of student attendance for each group class administered. It is noted that, on average, 17.5 group classes were presented during the six-month treatment period. On average, each student attended 15.3 classes, ranging from eighteen to fourteen classes. It was evident that absenteeism was higher for group classes than for CAI sessions. As with CAI sessions, attendance and frequency of classes was affected by school holidays, public and special holidays, and illness of the participating students and group-class instructors.

b. Progress

The progress and attendance registers were constructed by the researcher, and the participating lecturers were requested to enter the following information after each lesson:

- content of lesson, that is, work covered;
- general remarks regarding receptivity of class, lecturer opinion of student ability, etc.;
- specific remarks concerning weaker, more advanced or 'problem' students, etc.

c. On-the-spot- observation

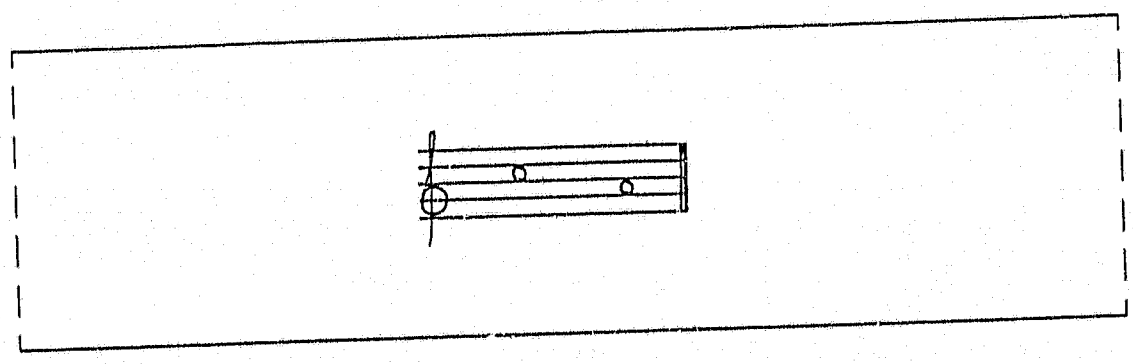
The researcher periodically attended group classes of both participating lecturers. These observation periods were conducted with permission from the lecturers and the researcher's participation was passive throughout the dura-

tion of the class lesson. The researcher noted lesson content, teaching methods, style of teaching, rapport between lecturer and students, general atmosphere of interactions, as well as the language medium of instruction. These observations are noted in Chapter 7.4.

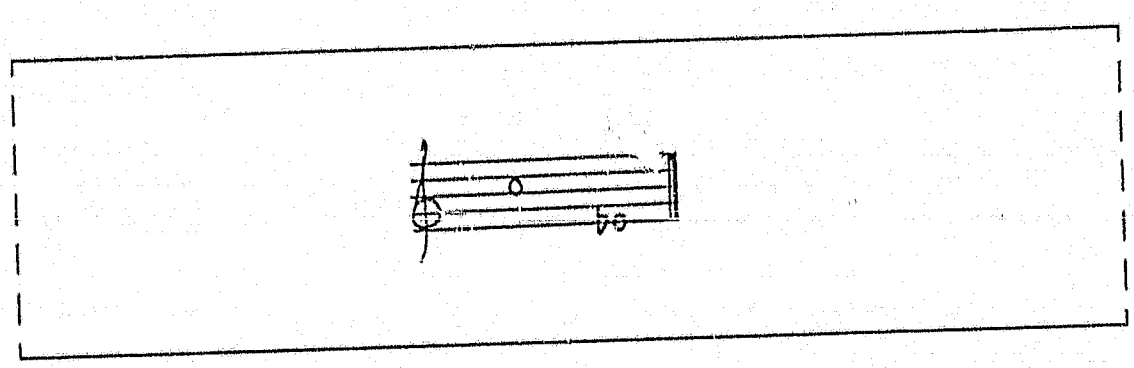
5.10 POST-TESTS

Post-tests were administered at the end of the six-month research period on 4 and 5 November 1985. Both pre-tests, that is, the initial pre-test and the second pre-test (at higher grade level) were administered now as post-tests. The identical tests were used and post-tests were at the same two grade levels for each individual (as previously administered). Post-tests (as well as pre-tests) were administered by the two lecturers who gave group- class instruction. These tests were administered, under supervision of the researcher, to all groups participating in the study, one grade level at a time. The complete test results as well as student records are presented in Appendix L.

One further point should be made regarding the administration of post-tests. It has been noted that students receiving CAI in interval recognition were taught to identify descending intervals in terms of the second note heard, whereas students receiving group-class instruction were taught to identify these in terms of the first note heard. Therefore, it should be obvious that each student was tested in the appropriate section of the post-test, according to the method taught. As the CAMETS tests stand (see Appendix F), descending intervals are asked in the intervallic approach (i.e., for CAI). These intervals were adapted for students using the tonal method of naming intervals, so that the answer given by the student would be the same (as intervallic answers). For example, the CAI group would identify the interval of



as a minor third. This would be changed when presented to the teacher-taught group to



so that a tonal answer would still be a minor third.

5.11 SCHEMATIC DISPLAY OF THE COMPARATIVE STUDY

The following schematic display (Figure 9 on page 101) shows the design of the comparative study and includes both quantitative and qualitative methodology. The CAMETS project is displayed sequentially to indicate the steps in the research process.

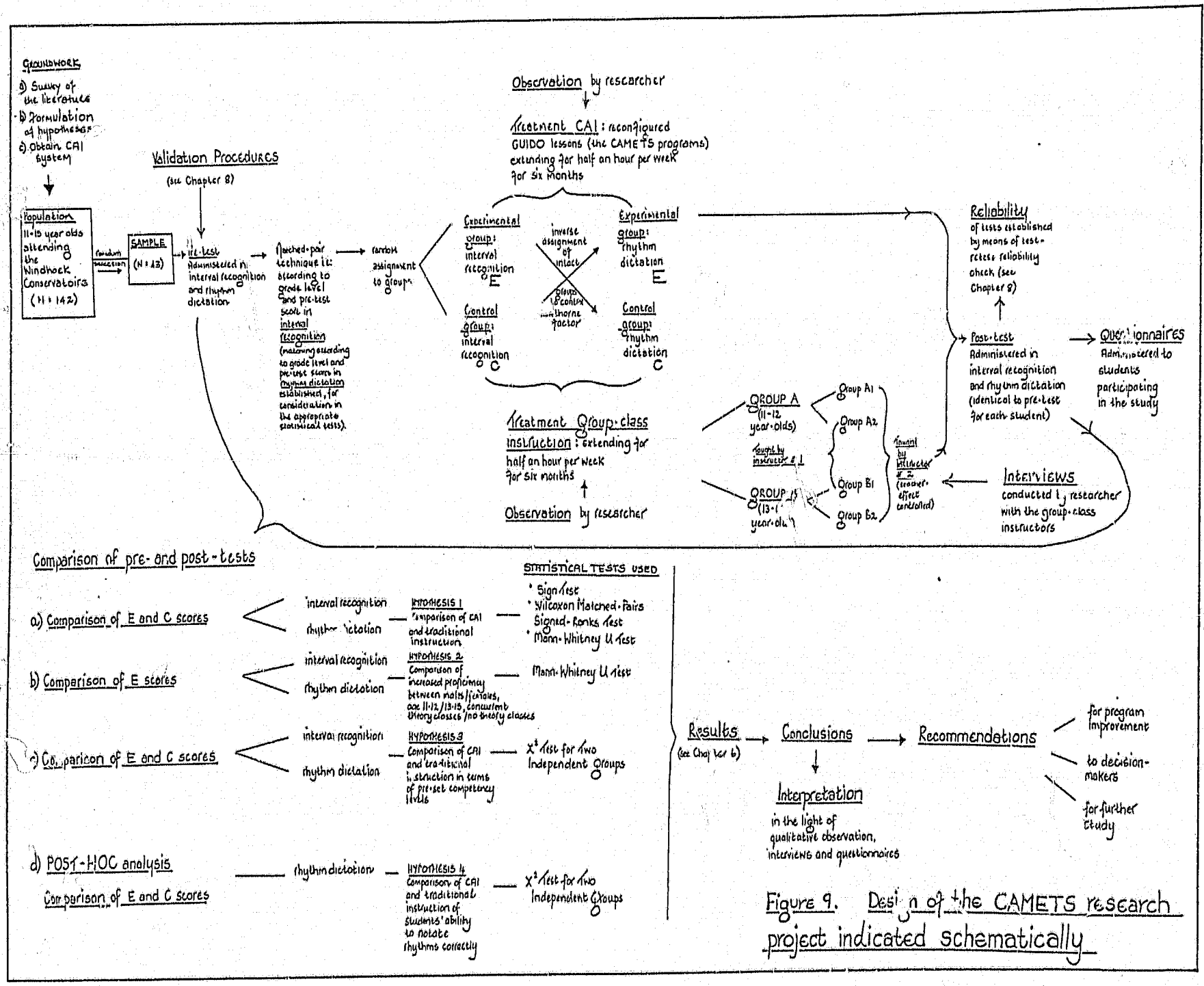


Figure 9. Design of the CAMETS research project indicated schematically

6.0 RESULTS OF THE COMPARATIVE STUDY

6.1 OPERATIONAL RESTATEMENT OF HYPOTHESIS 1

The null hypothesis (H_0) proposed for investigation was stated as follows:

There is no difference in improvement of aural-perception skills, specifically in interval recognition and rhythm dictation, in the comparison of student achievement scores between students, aged eleven to fifteen years, selected from the Windhoek Conservatoire, SWA, who receive CAI in these skills over a six-month period using the reconfigured Micro GUIDO Ear Training System (the CAMETS programs), and students of the same age group (selected from the Windhoek Conservatoire) who receive the conventional group-class instruction in the same skills over the same time-period, as measured on the CAMETS Grade Tests in Interval Recognition and Rhythm Dictation.

6.2 DATA ANALYSIS

The above hypothesis was tested by means of:

1. the Sign Test (Siegel 1956, pp. 68-75) to establish the direction of the differences within pairs;

2. the Wilcoxon Matched-Pairs Signed-Ranks Test (Siegel 1956, pp.75-83) to determine the relative magnitude of within-pair differences, and;

3. the Mann-Whitney U Test (Siegel 1956, pp. 116-127) to determine differences between the groups, considered independently, one grade level at a time.

1. Sign Test

The Sign Test was chosen for this study of two related groups because the study used ordinal measures within matched pairs, and therefore the differences might appropriately be represented as positive or negative changes. A significance level of $\alpha = .05$ was chosen. Since the alternative hypothesis predicted the direction of differences, the test was one-tailed.

Ho : group receiving CAI performs the same as teacher-taught group;

H1 : group receiving CAI performs better than teacher-taught group.

The comparative results of groups receiving alternate forms of instruction (CAI and group-class) in interval recognition and rhythm dictation are shown in Tables 3 and 4 respectively. The data in Table 3 yielded a one-tailed probability of occurrence under H_0 of $p = .090$. It is therefore concluded that the CAI group did not show an improvement over the teacher-taught group at the .05 level of significance, but that the improvement is significant at the .10 level. This comparison of groups refers specifically to student aural-perception skills in interval recognition.

The data in Table 4 yielded a one-tailed probability of occurrence under H_0 of $p = .105$. However, it was predicted that there would be more positive change than negative change. For $N = 16$, and $x \leq 5$ has a two-tailed probability of occurrence under H_0 of $p = .21$. These obtained values of x are not significant. Therefore, it is concluded that the CAI group did not show an improvement over the teacher-taught group, that, in fact, the teacher-taught group showed a far greater improvement over the CAI group (although this improvement was not significant). This comparison of groups refers specifically to student aural-perception skills in rhythm dictation.

Table 3. Statistical data of Sign Test: Table showing direction of within-pair differences of students exposed to alternate forms of instruction: CAI (experimental group) and teacher-taught (control group), matched according to pre-test scores in music Interval Recognition

PR	STUDENT NO.	EXPERIMENTAL PRE	EXPERIMENTAL POST	diff	STUDENT NO.	CONTROL PRE	CONTROL POST	diff	WITHIN-PR DIFF	DIR OF DIFF	SIGN
1	Student 1	80.00	70.00	-10.00	Student 17	70.00	60.00	-10.00	.00	E=C	0
2	Student 43	50.00	55.00	5.00	Student 4	60.00	55.00	-5.00	10.00	E>C	+
3	Student 25	40.00	50.00	10.00	Student 39	50.00	60.00	10.00	.00	E=C	0
4	Student 35	30.00	50.00	20.00	Student 28	20.00	40.00	20.00	.00	E=C	0
5	Student 6	80.00	45.00	-35.00	Student 41	70.00	50.00	-20.00	-15.00	E<C	-
6	Student 24	70.00	70.00	.00	Student 3	70.00	90.00	20.00	-20.00	E<C	-
7	Student 32	50.00	90.00	40.00	Student 27	55.00	40.00	-15.00	55.00	E>C	+
8	Student 31	40.00	70.00	30.00	Student 8	45.00	50.00	5.00	25.00	E>C	+
9	Student 22	60.00	100.00	40.00	Student 14	50.00	45.00	-5.00	45.00	E>C	+
10	Student 9	40.00	70.00	30.00	Student 40	40.00	30.00	-10.00	40.00	E>C	+
11	Student 15	40.00	45.00	5.00	Student 20	30.00	75.00	45.00	-40.00	E<C	-
12	Student 42	25.00	70.00	45.00	Student 36	25.00	40.00	15.00	30.00	E>C	+
13	Student 7	15.00	35.00	20.00	Student 18	20.00	40.00	20.00	.00	E=C	0
14	Student 10	53.30	60.00	6.70	Student 26	53.30	33.30	-20.00	26.70	E>C	+
15	Student 11	40.00	40.00	.00	Student 16	40.00	80.00	40.00	-40.00	E<C	-
16	Student 19	40.00	80.00	40.00	Student 29	33.30	40.00	6.70	33.30	E>C	+
17	Student 2	20.00	60.00	40.00	Student 33	33.30	40.00	6.70	33.30	E>C	+
18	Student 13	20.00	40.00	20.00	Student 5	20.00	40.00	20.00	.00	E=C	0
19	Student 30	13.30	40.00	26.70	Student 37	13.30	13.30	.00	26.70	E>C	+
											---
											x = 4
											p = .090
19	MEANS	42.45	60.00	17.55		42.01	48.51	6.49	11.05		n = 14

KEY TO COLUMN TITLES:

PR: Pair
diff: difference scores

PRE: Pre-test scores
WITHIN-PR DIFF: Within-pair difference scores

POST: Post-test scores
DIR OF DIFF: Direction of difference

Table 3. Statistical data of Sign Test: Table showing direction of within-pair differences of students exposed to alternate forms of instruction: CAI (ex perimental group) and teacher-taught (control group), matched according to pre-test scores in music Interval Recognition

PR	STUDENT NO.	EXPERIMENTAL PRE	POST	diff	STUDENT NO.	CONTROL PRE	POST	diff	WITHIN-PR DIFF	DIR OF DIFF	SIGN
1	Student 1	80.00	70.00	-10.00	Student 17	70.00	60.00	-10.00	.00	E=C	0
2	Student 43	50.00	55.00	5.00	Student 4	60.00	55.00	-5.00	10.00	E>C	+
3	Student 25	40.00	50.00	10.00	Student 39	50.00	60.00	10.00	.00	E=C	0
4	Student 35	30.00	50.00	20.00	Student 28	20.00	40.00	20.00	.00	E=C	0
5	Student 6	80.00	45.00	-35.00	Student 41	70.00	50.00	-20.00	-15.00	E<C	-
6	Student 24	70.00	70.00	.00	Student 3	70.00	90.00	20.00	-20.00	E<C	-
7	Student 32	50.00	90.00	40.00	Student 27	55.00	40.00	-15.00	55.00	E>C	+
8	Student 31	40.00	70.00	30.00	Student 8	45.00	50.00	5.00	25.00	E>C	+
9	Student 22	60.00	100.00	40.00	Student 14	50.00	45.00	-5.00	45.00	E>C	+
10	Student 9	40.00	70.00	30.00	Student 40	40.00	30.00	-10.00	40.00	E>C	+
11	Student 15	40.00	45.00	5.00	Student 20	30.00	75.00	45.00	-40.00	E<C	-
12	Student 42	25.00	70.00	45.00	Student 36	25.00	40.00	15.00	30.00	E>C	+
13	Student 7	15.00	35.00	20.00	Student 18	20.00	40.00	20.00	.00	E=C	0
14	Student 10	53.30	60.00	6.70	Student 26	53.30	33.30	-20.00	26.70	E>C	+
15	Student 11	40.00	40.00	.00	Student 16	40.00	80.00	40.00	-40.00	E<C	-
16	Student 19	40.00	80.00	40.00	Student 29	33.30	40.00	6.70	33.30	E>C	+
17	Student 2	20.00	60.00	40.00	Student 33	33.30	40.00	6.70	33.30	E>C	+
18	Student 13	20.00	40.00	20.00	Student 5	20.00	40.00	20.00	.00	E=C	0
19	Student 30	13.30	40.00	26.70	Student 37	13.30	13.30	.00	26.70	E>C	+
											----
											x = 4
19	MEANS	42.45	60.00	17.55		42.01	48.51	6.49	11.05		p = .090
											n = 14

KEY TO COLUMN TITLES:

PR: Pair
diff: difference scores

PRE: Pre-test scores
WITHIN-PR DIFF: Within-pair difference scores

POST: Post-test scores
DIR OF DIFF: Direction of difference

Table 4. Statistical data of Sign Test: Table showing direction of within-pair differences of students exposed to alternate forms of instruction: CAI (experimental group) and teacher-taught (control group), matched according to pre-test scores in Rhythm Dictation

PR	EXPERIMENTAL STUDENT NO.	PRE	POST	diff	CONTROL STUDENT NO.	PRE	POST	diff	WITHIN-PR DIFF	DIR OF DIFF	SIGN
1	Student 4	52.00	62.80	10.80	Student 1	53.80	17.70	-36.10	46.90	E>C	+
2	Student 38	15.50	32.10	16.60	Student 43	21.60	53.50	31.90	-15.30	E<C	-
3	Student 8	41.10	43.50	2.40	Student 6	30.80	51.30	11.50	-9.10	E<C	-
4	Student 41	29.80	41.50	11.70	Student 32	26.30	48.80	22.50	-10.80	E<C	-
5	Student 3	19.20	49.50	30.30	Student 24	19.50	69.00	49.50	-19.20	E<C	-
6	Student 27	17.90	21.00	3.10	Student 31	11.30	33.10	21.80	-18.70	E<C	-
7	Student 36	44.10	77.80	33.70	Student 42	44.90	69.00	24.10	9.60	E>C	+
8	Student 40	30.70	90.00	59.30	Student 23	31.60	44.10	12.50	46.80	E>C	+
9	Student 18	23.00	23.50	.50	Student 21	25.10	56.70	31.60	-31.10	E<C	-
10	Student 14	15.40	34.00	18.60	Student 7	21.60	36.50	14.90	3.70	E>C	+
11	Student 20	5.00	40.00	35.00	Student 15	9.20	49.50	40.30	-5.30	E<C	-
12	Student 33	46.90	65.00	18.10	Student 19	51.90	13.10	-38.80	56.90	E>C	+
13	Student 26	37.00	25.00	-12.00	Student 30	37.40	97.50	60.10	-72.10	E<C	-
14	Student 39	35.70	45.80	10.10	Student 10	33.60	47.50	13.90	-3.80	E<C	-
15	Student 16	26.20	25.50	-.70	Student 2	26.00	42.10	16.10	-16.80	E<C	-
16	Student 29	16.20	29.00	12.80	Student 11	14.50	29.00	14.50	-1.70	E<C	-
											----
											x = 5
											p = .105
16	MEANS	28.48	44.13	15.64		29.26	47.40	18.14	2.50		n = 16

KEY TO COLUMN TITLES:

PP: Pair
diff: difference scores

PRE: Pre-test scores
WITHIN-PR DIFF: Within-pair difference scores

POST: Post-test scores
DIR OF DIFF: Direction of difference

2. Wilcoxon Matched-Pairs Signed-Ranks Test

The Wilcoxon Matched-Pairs Signed-Ranks Test was chosen for the comparison of student achievement scores because the study employed two related samples and it yielded difference scores which might be ranked in order of absolute magnitude. A significance level of $\alpha = .05$ was chosen. Since the alternative hypothesis predicted the direction of differences, the test was one-tailed.

Ho : group receiving CAI performs the same as teacher-taught group;

H1 : group receiving CAI performs better than teacher-taught group.

The results of the comparison of groups receiving alternate forms of instruction (CAI and group-class) in interval recognition and rhythm dictation are given in Tables 5 and 6 respectively. From this data, the smaller of the sums of the like-signed ranks, T , was 27 and 50 for the experimental (CAI) groups in interval recognition and rhythm dictation respectively. Critical values from the sampling distribution of T are given as ≤ 26 (N = 14) and ≤ 36 (N = 16) at the.05 level of significance for a one-tailed test (Kazmier 1979, p. 428). The values of T obtained from the research study are not significant. It is therefore concluded that there is no difference in achievement scores between the two groups exposed to alternate forms of instruction (CAI and teacher- taught) in aural-perception skills in interval recognition and rhythm dictation. However, it is noted that the critical value of T (26) is very close to that obtained in the study (T = 27). It is evident that the experimental group which did interval recognition with the computer achieved far better results than their matched counterparts taught by the conventional method, although this achievement was not significant. Also, the prediction that students learning rhythm dictation with the computer would out-perform their counterparts taught by conventional

Table 5. Statistical data of Wilcoxon Matched-Pairs Signed-Ranks Test: Table showing rankings of within-pair differences for each group to alternate forms of instruction: CAI (experimental group) and teacher-taught (control group), matched according to pre-test scores in music Interval Recognition

PR	EXPERIMENTAL STUDENT NO.	PRE	POST	diff	CONTROL STUDENT NO.	PRE	POST	diff	WITHIN-PR DIFF	RANK OF DIFF	RANK LESS FREQ SIGN
1	Student 1	80.00	70.00	-10.00	Student 17	70.00	60.00	-10.00	.00	1	
2	Student 43	50.00	55.00	5.00	Student 4	60.00	55.00	-5.00	10.00		
3	Student 25	40.00	50.00	10.00	Student 39	50.00	60.00	10.00	.00		
4	Student 35	30.00	50.00	20.00	Student 28	20.00	40.00	20.00	.00		
5	Student 6	80.00	45.00	-35.00	Student 41	70.00	50.00	-20.00	-15.00	-2	2
6	Student 24	70.00	70.00	.00	Student 3	70.00	90.00	20.00	-20.00	-3	3
7	Student 32	50.00	90.00	40.00	Student 27	55.00	40.00	-15.00	55.00	14	
8	Student 31	40.00	70.00	30.00	Student 8	45.00	50.00	5.00	25.00	4	
9	Student 22	60.00	100.00	40.00	Student 14	50.00	45.00	-5.00	45.00	13	
10	Student 9	40.00	70.00	30.00	Student 40	40.00	30.00	-10.00	40.00	11	
11	Student 15	40.00	45.00	5.00	Student 20	30.00	75.00	45.00	-40.00	-11	11
12	Student 42	25.00	70.00	45.00	Student 36	25.00	40.00	15.00	30.00	7	
13	Student 7	15.00	35.00	20.00	Student 18	20.00	40.00	20.00	.00		
14	Student 10	53.30	60.00	6.70	Student 26	53.30	33.30	-20.00	26.70	5.5	
15	Student 11	40.00	40.00	.00	Student 16	40.00	80.00	40.00	-40.00	-11	11
16	Student 19	40.00	80.00	40.00	Student 29	33.30	40.00	6.70	33.30	8.5	
17	Student 2	20.00	60.00	40.00	Student 33	33.30	40.00	6.70	33.30	8.5	
18	Student 13	20.00	40.00	20.00	Student 5	20.00	40.00	20.00	.00		
19	Student 30	13.30	40.00	26.70	Student 37	13.30	13.30	.00	26.70	5.5	
										T =	27
19	MEANS	42.45	60.00	17.55		42.01	48.51	6.49	11.05	N =	14

KEY TO COLUMN TITLES:

PR: Pair
diff: difference scores

PRE: Pre-test scores
WITHIN-PR DIFF: Within-pair difference scores

POST: Post-test scores
RANK OF DIFF: Rank of difference

RANK LESS FREQ SIGN: Rank of less frequent sign

Table 6. Statistical data of Wilcoxon Matched-Pairs Signed-Ranks Test: Table showing rankings of within-pair differences for each group to alternate forms of instruction: CAI (experimental group) and teacher-taught (control group), matched according to pre-test scores in Rhythm Dictation

PR	EXPERIMENTAL STUDENT NO.	PRE	POST	diff	CONTROL STUDENT NO.	PRE	POST	diff	WITHIN-PR DIFF	RANK OF DIFF	RANK LESS FREQ SIGN
1	Student 4	52.00	62.80	10.80	Student 1	53.80	17.70	-36.10	46.90	14	14
2	Student 38	15.50	32.10	16.60	Student 43	21.60	53.50	31.90	-15.30	-8	
3	Student 8	41.10	43.50	2.40	Student 6	39.80	51.30	11.50	-9.10	-5	
4	Student 41	29.80	41.50	11.70	Student 38	26.30	48.80	22.50	-10.20	-7	
5	Student 3	19.20	49.50	30.30	Student 24	19.50	69.00	49.50	-19.20	-11	
6	Student 27	17.90	21.00	3.10	Student 31	11.30	33.10	21.80	-18.70	-10	
7	Student 36	44.10	77.80	33.70	Student 42	44.90	69.00	24.10	9.60	6	6
8	Student 40	30.70	90.00	59.30	Student 23	31.60	44.10	12.50	46.80	13	13
9	Student 18	23.00	23.50	.50	Student 21	25.10	56.70	31.60	-31.10	-12	
10	Student 14	15.40	34.00	18.60	Student 7	21.60	36.50	14.90	3.70	2	2
11	Student 20	5.00	40.00	35.00	Student 15	9.20	49.50	40.30	-5.30	-4	
12	Student 33	46.90	65.00	18.10	Student 19	51.90	13.10	-38.80	56.90	15	15
13	Student 26	37.00	25.00	-12.00	Student 30	37.40	97.50	60.10	-72.10	-16	
14	Student 39	35.70	45.80	10.10	Student 10	33.60	47.50	13.90	-3.80	-3	
15	Student 16	26.20	25.50	-.70	Student 2	26.00	42.10	16.10	-16.80	-9	
16	Student 29	16.20	29.00	12.80	Student 11	14.50	29.00	14.50	-1.70	-1	
16	MEANS	28.48	44.13	15.64		29.26	47.40	18.14	2.50		

T = 50
N = 16

KEY TO COLUMN TITLES:

PR: Pair
diff: difference scores

PRE: Pre-test scores
WITHIN-PR DIFF: Within-pair difference scores

POST: Post-test scores
RANK OF DIFF: Rank of difference

RANK LESS FREQ SIGN: Rank of less frequent sign

methods was inaccurate. Only five pairs showed improvement in the direction expected.

It would have been interesting to compare the within-pair differences at different grade levels, in an attempt to ascertain the relative efficacy of CAI at different initial levels of student achievement. However, it is noted that in order to apply the Wilcoxon Matched-Pairs Signed-Ranks Test, a minimum number of pairs with observable differences is required, namely five pairs. Therefore, this would only have been possible with students at a grade 4 level, matched according to pre-test scores in interval recognition, and with students at both a grade 4 and 5 level, matched according to pre-test scores in rhythm dictation, where five pairs of scores were available. Since the critical value of T (for N = 5) is zero, it was immediately obvious that the null hypothesis could not be rejected. This was because, in each case (Grade 4: intervals, Grades 4 and 5: rhythms) at least one within-pair difference score was not in the direction predicted. Since this score must be ranked, T would always be greater than zero.

However, it would be possible to test Hypothesis 1 to determine the differences between the groups at one grade level at a time, if the two groups (experimental and control) were considered as independent groups and not as related groups (as carried out in the previous statistical procedures).

3. Mann-Whitney U Test for Two Independent Groups

The experimental and control groups constituted two independent groups, and the measure of student improvement constituted an ordinal measure at best. For these reasons the Mann-Whitney U Test was appropriate for analysing these data. A significance level of $\alpha = .05$ was chosen. Since the alternative hypothesis predicted the direction of differences, the test was one-tailed.

Ho : group receiving CAI the same as teacher-taught group;

H_1 : group receiving CAI performs better than teacher-taught group.

The values of U were determined by the counting method, for each grade level, with both experimental groups (CAI in interval recognition; CAI in rhythm dictation) considered separately. These are given in Table 7.

From the data in Table 7 it is evident that the probabilities associated with values of U are greater than $\alpha = .05$ in <u>all</u> cases. Therefore, the decision is that the data does not give evidence which justifies rejecting H_0 at the previously set level of significance. The conclusion is that this data does support the hypothesis that there is no difference in achievement scores between the two groups exposed to alternate forms of instruction (CAI and teacher-taught) in aural-perception skills in interval recognition and rhythm dictation, when the independent groups are compared at different grade levels.

6.3 OPERATIONAL RESTATEMENT OF HYPOTHESIS 2

The null hypothesis (H_0) proposed for investigation was stated as follows:

There is no difference between students of different sex, age group and between students who attend regular music theory classes and students who do not, in the degree of student improvement in aural-perception skills in interval recognition and rhythm dictation, as measured on the CAMETS tests, of students aged between eleven and fifteen years attending the Windhoek Conservatoire, who receive CAI in these specific skills over a six-month period.

Table 7. Statistical data of Mann-Whitney U Test showing differences of independent group scores at different grade levels:
Interval Recognition and Rhythm Dictation

	Experimental group (CAI)			Control group (Teacher)		
Grade 8: Interval Recognition						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
1	80.00	70.00	-10.00	4	60.00	55.00	-5.00
25	40.00	50.00	10.00	17	70.00	60.00	-10.00
35	30.00	50.00	20.00	28	20.00	40.00	20.00
43	50.00	55.00	5.00	38	20.00	30.00	10.00

-10 E | -10 C | -5 C | 5 E | 10 E | 10 C | 20 E | 20 C
n1 = 4; n2 = 4; U = 7.5; p = .44

Grade 6: Interval Recognition						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
6	80.00	45.00	-35.00	3	70.00	90.00	20.00
24	70.00	70.00	.00	8	45.00	50.00	5.00
31	40.00	70.00	30.00	27	55.00	40.00	-15.00
32	50.00	90.00	40.00	34	65.00	90.00	25.00
				41	70.00	50.00	-20.00

-35 E | -20 C | -15 C | 0 E | 5 C | 20 C | 25 C | 30 E | 40 E
n1 = 4; n2 = 5; U = 8; p = .365

Grade 5: Interval Recognition						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
7	15.00	35.00	20.00	14	50.00	45.00	-5.00
9	40.00	70.00	30.00	18	20.00	40.00	20.00
15	40.00	45.00	5.00	20	30.00	80.00	50.00
21	100.00	100.00	.00	36	25.00	40.00	15.00
22	60.00	100.00	40.00	40	40.00	30.00	-10.00
23	80.00	100.00	20.00				
42	25.00	70.00	45.00				

-10 C | -5 C | 0 E | 5 E | 15 C | 20 C | 20 E | 20 E | 30 E | 40 E | 45 E | 50 C
n1 = 5; n2 = 7; U = 12; p = .216

Grade 4: Interval Recognition						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
2	20.00	60.00	40.00	5	20.00	40.00	20.00
10	53.30	60.00	6.70	16	40.00	80.00	40.00
11	40.00	40.00	.00	26	53.30	33.30	-20.00
13	20.00	40.00	20.00	29	33.30	40.00	6.70
19	40.00	80.00	40.00	33	33.30	40.00	6.70
30	13.30	40.00	26.70	37	13.30	13.30	.00
				39	50.00	60.00	10.00

-20 C | 0 C | 0 E | 6.7 E | 6.7 C | 6.7 C | 10 C | 20 C | 20 E | 26.7 E | 40 E | 40 E | 40 C
n1 = 6; n2 = 7; U = 13; p = .105

	Experimental group (CAI)			Control group (Teacher)		
Grade 8: Rhythm Dictation						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
4	52.00	62.80	10.80	1	53.80	17.70	-36.10
17	41.20	59.80	18.60	25	63.20	67.40	4.20
28	7.40	27.70	20.30	35	22.50	11.40	-11.10
38	15.50	32.10	16.60	43	21.60	53.50	31.90

-36.1 C | -11.1 C | 4.2 C | 10.8 E | 16.6 E | 18.6 E | 20.3 E | 31.9 C
n1 = 4; n2 = 4; U = 4; p = .171

Grade 6: Rhythm Dictation						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
3	19.20	49.50	30.30	6	39.80	51.30	11.50
8	41.10	43.50	2.40	24	19.50	69.00	49.50
27	17.90	21.00	3.10	31	11.30	33.10	21.80
34	57.60	73.00	15.40	32	26.30	48.80	22.50
41	29.80	41.50	11.70				

2.4 E | 3.1 E | 11.5 C | 11.7 E | 15.4 E | 21.8 C | 22.5 C | 30.3 E | 49.5 C
n1 = 4; n2 = 5; U = 5; p = .143

Grade 5: Rhythm Dictation						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
14	15.40	34.00	18.60	7	21.60	36.50	14.90
16	23.00	23.50	.50	9	42.00	47.50	5.50
20	5.00	40.00	35.00	15	9.20	49.50	40.30
36	44.10	77.80	33.70	21	25.10	56.70	31.60
40	30.70	90.00	59.30	22	30.40	57.30	26.90
				23	31.60	44.10	12.50
				42	44.90	69.00	24.10

.5 E | 5.5 C | 12.5 C | 14.9 C | 18.6 E | 24.1 C | 26.9 C | 31.6 C | 33.7 E | 35 E | 40.3 C | 59.3 E
n1 = 5; n2 = 7; U = 13; p = .265

Grade 4: Rhythm Dictation						
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
5	33.30	92.00	58.70	2	26.00	42.10	16.10
16	26.20	25.50	-.70	10	33.60	47.50	13.90
26	37.00	25.00	-12.00	11	14.50	29.00	14.50
29	12.00	29.00	17.00	13	39.50	55.00	15.50
33	46.90	65.00	18.10	19	51.90	13.10	-38.80
37	.00	47.40	47.40	30	37.40	97.50	60.10
39	35.70	45.8	10.10				

-38.8 C | -12 E | -.7 E | 10.1 E | 13.9 C | 14.5 C | 15.5 C | 16.1 C | 17 E | 18.1 E | 47.4 E | 58.7 E | 60 E
n1 = 6; n2 = 7; U = 19; p = .418

6.4 DATA ANALYSIS

The above hypothesis was tested by means of the Mann-Whitney U Test to determine differences between the two independent groups. Each independent variable (sex, age group and presence/absence of music theory classes) was considered separately, to determine if these variables had an influence on the results. It is noted that this procedure was carried out only where enough data could be generated from the sample.

The Mann-Whitney U Test was chosen because this study employed two independent samples, used small samples, and measurement which was in an ordinal scale. A significance level of $\alpha = .05$ was chosen. Since the alternative hypothesis predicted the direction of differences, the test was one-tailed.

1.

Ho : males receiving CAI perform the same as females receiving CAI;

Hi : males receiving CAI perform better than females receiving CAI.

2.

Ho : students aged between 13 and 15 receiving CAI perform the same as students aged between 11 and 12 receiving CAI;

Hi : students aged between 13 and 15 receiving CAI perform better than students aged between 11 and 12 receiving CAI.

3.

Ho : students attending music theory classes who receive CAI perform the same as students not attending theory classes who receive CAI;

Hi : students attending music theory classes who receive CAI perform better than students not attending theory classes who receive CAI.

The values of U were determined by the counting method, for each grade level, with both experimental groups (CAI in interval recognition; CAI in rhythm dictation) considered separately. These are given in Table 8. From the data in Table 8 it is evident that the probabilities associated with values of U are greater than $\alpha = .05$ in all cases. Therefore, the conclusion is that this data supports the hypothesis that certain independent variables (sex, age group, presence/absence of music theory classes) do not influence the degree of student improvement in the development of aural-perception skills amongst the students in the sample who received CAI in these specific skills, as was predicted.

6.5 OPERATIONAL RESTATEMENT OF HYPOTHESIS 3

The null hypothesis (H_0) proposed for investigation was stated as follows:

There is no difference between students (from the selected sample) receiving CAI in interval recognition and rhythm dictation, and students receiving group-class instruction in the same skills in the degree of proficiency in these aural-perception skills, as measured on the CAMETS tests, when achievement is specified in terms of pre-set competency levels for each skill: interval recognition and rhythm dictation. The pre-set competency levels on the CAMETS tests were determined for each CAMETS test (pre- and post-test) and for each section of the CAMETS test, namely interval recognition and rhythm dictation as follows:

Table 8. Statistical data of Mann-Whitney U Tests on independent variables: sex, age group and music theory

SEX
Grade 4: Interval Recognition: (CAI)

	MALE (E)			FEMALE (C)		
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
2	20.00	60.00	40.00	11	40.00	40.00	.00
10	53.30	60.00	6.70	13	20.00	40.00	20.00
19	40.00	80.00	40.00	30	13.30	40.00	26.70

.0	6.7	20	26.7	40	40
C	E	C	C	E	E

n1 = 3; n2 = 3; U = 2; p = .20

SEX
Grade 8: Rhythm Dictation: (CAI)

	MALE (E)			FEMALE (C)		
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
29	16.20	29.00	12.80	5	33.30	92.00	58.70
33	46.90	65.00	18.10	16	26.20	25.50	-.70
37	.00	47.40	47.40	26	37.00	25.00	-12.00
				39	35.70	45.80	10.10

-12	-.7	10.1	12.8	18.1	47.4	58.7
C	C	C	E	E	E	C

n1 = 3; n2 = 4; U = 3; p = .20

AGE
Grade 5: Interval Recognition: (CAI)

	11-12 yr olds (E)			13-15 yr olds (C)			
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
21	100.00	100.00	.00	7	15.00	35.00	20.00
22	60.00	100.00	40.00	9	40.00	70.00	30.00
23	80.00	100.00	20.00	15	40.00	45.00	5.00
				42	25.00	70.00	45.00

.0	5	20	20	30	40	45
E	C	C	E	C	E	C

n1 = 3; n2 = 4; U = 5; p = .429

AGE
Grade 4: Rhythm Dictation: (CAI)

	11-12 yr olds (E)			13-15 yr olds (C)			
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
5	33.30	92.00	58.70	29	16.20	29.00	12.80
16	26.20	25.50	-.70	37	.00	47.40	47.40
26	37.00	25.00	-12.00	39	35.70	45.80	10.10
33	46.90	65.00	18.10				

-12	-.7	10.1	12.8	18.1	47.4	58.7
E	E	C	C	E	C	E

n1 = 3; n2 = 4; U = 5; p = .429

MUSIC THEORY
Grade 5: Interval Recognition (CAI)

	MUSIC THEORY (E)			NO MUSIC THEORY (C)			
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
9	40.00	70.00	30.00	7	15.00	35.00	20.00
21	100.00	100.00	.00	15	40.00	45.00	5.00
				22	60.00	100.00	40.00
				23	80.00	100.00	20.00
				42	25.00	70.00	45.00

.0	5	20	20	30	40	
E	C	C	C	E	C	C

n1 = 2; n2 = 5; U = 3; p = .286

MUSIC THEORY
Grade 4: Rhythm Dictation: (CAI)

	MUSIC THEORY (E)			NO MUSIC THEORY (C)			
S No.	Pre	Post	DIFF	S No.	Pre	Post	DIFF
5	33.30	92.00	58.70	26	37.00	25.00	-12.00
16	26.20	25.50	-.70	29	16.20	29.50	12.80
37	.00	47.40	47.40	33	46.90	65.00	18.10
39	35.70	45.80	10.10				

-12	-.7	10.1	12.8	18.1	47.4	58.7
C	E	E	C	C	E	E

n1 = 3; n2 = 4; U = 4; p = .314

a) CAMETS pre-test: Intervals: pass ≥ 60%
fail < 60%
Rhythms : pass ≥ 40%
fail < 40%

b) CAMETS post-test: Intervals: pass ≥ 80%
fail < 80%
Rhythms : pass ≥ 60%
fail < 60%

6.6 DATA ANALYSIS

The X^2 Test for Two Independent Samples was chosen because the two groups (CAI group and teacher-taught group) were independent, because the 'scores' under study were frequencies in discrete categories (pass and fail), and because the number of students in the sample was greater than forty. A significance level of $\alpha = .05$ was chosen. Since the alternative hypothesis predicted the direction of differences, the test was one-tailed.

Ho : group receiving CAI performs the same as teacher-taugnt group when the degree of skill proficiency is predetermined;

H . group receiving CAI performs better than teacher-taught group when the degree of skill proficiency is predetermined

Four X^2 tests for independent samples were run, one for each of the comparisons between groups on both CAMETS pre- and post-test scores, in each section of the CAMETS test - interval recognition and rhythm dictation. The 2 x 2 contingency tables showing the frequency of cases in the discrete categories is given in Table 9.

Table 9. X^2 test for Two Independent Groups: mode of instruction and observed competency

a) Interval Recognition: CAMETS Pre-test

COMPETENCY	GROUP: CAI	GROUP: TEACHER	Total
Pass > 60%	6	5	11
Fail < 60%	15	17	32
Total	21	22	43

$X^2 = 0.00799$; df = 1; $p < .90$

b) Interval Recognition: CAMETS Post-test

COMPETENCY	GROUP: CAI	GROUP: TEACHER	Total
Pass > 80%	5	4	9
Fail < 80%	16	18	34
Total	21	22	43

$X^2 = 0.00616$; df = 1; $p < .90$

c) Rhythm Dictation: CAMETS Pre-test

COMPETENCY	GROUP: CAI	GROUP: TEACHER	Total
Pass > 40%	6	5	11
Fail < 40%	16	16	32
Total	22	21	43

$X^2 = 0.008$; df = 1; $p < .90$

d) Rhythm Dictation: CAMETS Post-test

COMPETENCY	GROUP: CAI	GROUP: TEACHER	Total
Pass > 60%	6	4	10
Fail < 60%	16	17	33
Total	22	21	43

$X^2 = 0.077$; df = 1; $p < .70$

From the data in Table 9 it is evident that the probabilities associated with values of X^2 are far greater than $\alpha = .05$ in all four tests. Therefore, the conclusion is that this data supports the hypothesis that there is no difference in the degree of proficiency obtained between students receiving CAI and students receiving group-class instruction in specific aural-perception skills, when achievement is determined in terms of pre-set competency levels for each skill. It is further evident from the observed frequencies of cases in the discrete categories, that the majority of students did not achieve the expected level of competency, in both groups (CAI and teacher), on both tests (pre- and post-) and in both sections of the CAMETS tests (interval recognition and rhythm dictation).

6.7 POST HOC ANALYSIS: STUDENT PROFICIENCY IN NOTATING RHYTHMS

The researcher examined student answer papers of the rhythm dictation questions set in the CAMETS pre-test, to specifically determine the correctness of note-groupings given in the answers. The rules regarding note- groupings are stated in various rudiments of music books. The general rule is that one should group together as many notes as make one beat. To this rule, a number of exceptions are given. Student answers were examined in terms of these rules in the following manner. Each grade level of the CAMETS tests comprised four rhythms. If a student made more than one note-grouping error in notating a particular rhythm, this answer would be counted as incorrect. If a student used correct note-groupings in at least three of the four rhythms, that student was regarded as having shown adequate proficiency in ability to group notes correctly. However, if a student used incorrect note-groupings in more than one of the rhythm questions, he/she was regarded as not having obtained an adequate level of proficiency. Stated another way, the pre-set level of competency in note-groupings was set at equal to or greater than seventy-five per cent for a 'pass' (since three out of four must be correct) and less than seventy-five per cent for a 'fail' (since two

out of four incorrect answers is considered inadequate). Obviously, in classifying students according to the above criterion levels, the researcher considered each student answer in terms of the given time signature, which naturally determines how notes must be grouped.

Justification for this choice of a seventy-five per cent proficiency level is made on logical grounds, in a similar manner to that presented as a rationale for Hypothesis 3 (cf. Ch. 1.4.3.1). It is argued that a lower expected competency level would not indicate student proficiency in this notational skill and that a higher level would be an excessive expectancy. Furthermore, precedents of a similar expected level of competency used in studies by Kuhn and Lorton (1981) and Hofstetter (1980) are again noted. Finally, the choice of a seventy-five per cent proficiency level was made to facilitate marking of student answers. Student scores could be easily calculated if correct notation was evident in three of the four rhythm questions.

It must be pointed out that note-groupings were considered for each student answer, irrespective of whether the student answered the rhythm correctly or incorrectly. Furthermore, it is observed that it was possible for a student to fail the note groupings despite having passed the section on rhythm dictation or vice verse. This was possible because of the relatively low weighting accorded to note-groupings in the scheme of marking used in this research. Incorrect note-groupings would therefore represent a minimal decrease in student score. A student could lose a maximum of between eight and twenty per cent if he/she incorrectly grouped the notes in every rhythm question (refer to Appendix F, Section D: Scheme of marking D2, g). Student competency levels for note- groupings were then classified in a 2 x 2 contingency table indicating whether the student received CAI or teacher-taught instruction in rhythm dictation and whether the student had passed or failed in terms of the pre-set competency levels. Thereafter, the researcher examined note-groupings given in student answers in the CAMETS post-test in the same manner as above, and categorised these responses in exactly the same way, with the same competency levels. It was observed that students who showed competency in note-groupings on the pre- tests displayed the same proficiency on the post-tests in every instance, that is,

all students who passed the pre-tests also passed the post-tests. Therefore, these students (in both groups) were discarded from the sample, since the researcher wished to determine the number of students who were unable to group notes correctly on the pre-test, and were able to group notes correctly on the post-test. It would then be assumed that an increase in proficiency in notational ability could be directly attributed to the mode of instruction, namely CAI or conventional instruction. Since those who passed the pre-test also passed the post-test (in note-groupings), these students were not capable of change in ability to group notes correctly and could be discarded from the sample.

It was hypothesised that students (from the selected sample) receiving conventional instruction in rhythm dictation would show a higher degree of proficiency in ability to group notes correctly in the process of notating rhythms on the CAMETS tests over a six- month period than students receiving CAI in rhythm dictation for the same length of time, when the degree of proficiency in the notational ability was determined in terms of a pre-set competency level.

The rationale for this hypothesis was that students taught in the group class received constant practice in the notation of rhythms, whereas the computer group did not. This difference lies in the notion of notation, where students receiving group-class instruction would actually write down the rhythms, using pencil and paper, whereas the CAI group would respond to questions in rhythm dictation by touching boxes marked with appropriate note-values, and the computer would notate the rhythm by printing the correct answer on the screen. This observation is fully developed later in the dissertation (q.v. Ch. 9.3).

The X^2 Test for Two Independent Groups was chosen because the two groups (CAI and conventional) were independent, because the 'scores' under study were in discrete categories (pass and fail), because the number of students in the sample was between twenty and forty and all expected frequencies were within tolerable limits, i.e., ≥ 5 (Siegel 1956, p. 110). A significance level of $\alpha = .05$ was chosen. Since

the alternative hypothesis predicted the direction of differences, the test was one-tailed.

Ho : teacher-taught group performs the same as group receiving CAI when the degree of skill proficiency in rhythm notation is predetermined;

Hı : teacher-taught group performs better than group receiving CAI when the degree of skill proficiency in rhythm notation is predetermined.

The observed frequencies are given in Table 10.

From the data in Table 10 it is evident that the probability associated with the value of X^2 is greater than $\alpha = .05$ ($p < .10$). Therefore, it is concluded that there is no difference in the degree of proficiency obtained between students receiving group- class instruction and students receiving CAI, in ability to notate rhythms correctly, when proficiency in the skill is determined in terms of a pre-set competency level. However, it is evident that the teacher-taught group showed a far greater proficiency in this skill than their counterparts receiving CAI, although not statistically significant.

Table 10. X^2 Test for Two Independent Groups. Table showing mode of instruction and observed change in student ability to notate rhythms correctly

COMPETENCY	GROUP: CAI	GROUP: Teacher	Total
No change	10	5	15
Change	5	11	16
Total	15	16	31

$X^2 = 2.5996$; df = 1; $p < .10$

Notes: 'No change': this row indicates the number of students in each group who failed 'note-groupings' on both CAMETS pre- and post-tests (that is students who scored less than 75 per cent); 'Change': this row indicates the number of students in each grou who failed the CAMETS pre-test in 'note-groupings' but passed the post-test (that is, students who got seventy-five per cent of not groupings correct after the six-month treatment period).

7.0 DESCRIPTIVE DATA : QUESTIONNAIRES, INTERVIEWS AND OBSERVATION

This chapter provides supplementary information regarding the present comparative study, which was gleaned from questionnaires, interviews and observation. It gives multiple perspectives of the alternative teaching methods considered in this comparative study from the point of view of music educators and the participating students themselves, in order to determine the relative merits of these educational alternatives within the particular context of this study. The reactions, opinions and impressions of learners and teachers associated with this study provide information about <u>their</u> perceptions. Congruence between these reactions and the actual statistical interpretation of change in the samples exposed to different educational mediums is sought, in an attempt to align what actually occurred (the results) with what was perceived to be taking place.

Therefore, qualitative methods were used to provide additional information which might assist in the interpretation of the quantitative data obtained from the experimental study. In many respects, the descriptive data obtained from questionnaires, interviews and observations is supportive of the measurement data. However, this chapter serves only to present the descriptive data. Interpretation and discussion of the findings of the experimental study are presented in Chapters 9 and 10, in which the results of the experiment are considered in the light of this descriptive data.

Questionnaires were administered to participating students at the end of the research project to determine the relative strengths and weaknesses of the alternative educational methods (CAI and teacher-taught), to ascertain their perception of the computer program and group-class activity, as well as the benefits to them derived from each. Questionnaires administered to music educators were intended to determine their attitudes toward the use of computers in music education, the specific computer program used in this study and whether or not learning experiences appropriate for the learners are

being served. It is noted that results of questionnaires are intended solely as descriptive information, and that data obtained is not subjected to statistical analysis, besides being stated in terms of percentages of responses. It was hoped that this information would serve to inform the educational process within the particular context of this study.

7.1 QUESTIONNAIRE : STUDENTS

A questionnaire was administered subsequent to the post-tests after the six-month treatment period to the two groups - those who did interval recognition on the computer and those who did rhythm dictation on the computer. It was administered by the researcher with both group-class lecturers acting in an invigilating capacity. The student questionnaire is appended (Appendix H).

The first part of the questionnaire (Section A) was formulated to determine environmental considerations of students working with the computer, the extent of supervision and assistance perceived by students to be necessary and whether or not students were able to operate the computer system adequately. Although it was previously observed that suitable premises for the computer were not initially available, the majority of students working with the computer (74%) stated that extraneous sounds (the sound of guitar being taught in the same room) did not distract them from their task. Furthermore, when suitable arrangements were made during the third school-quarter, only five per cent of the students considered this desirable, as they required constant assistance. This is concordant with the finding that most students thought they were able to operate the computer satisfactorily without frequent assistance (83%). Only seventeen per cent said they required frequent assistance. The remaining questions in Section A were constructed to determine whether or not students could cope when confronted with operating problems or procedures that occurred frequently. In each of these situations the majority of students provided the correct response. Students were least familiar

with loading procedures as the researcher usually did this at each lesson.

Section B of the student questionnaire was directed at students who did interval recognition on the computer while Section C was directed at students who did rhythm dictation lessons. The questions in both sections were identical except for this difference. Questions were asked to determine how frequently the program malfunctioned, the extent to which practice lessons were used, whether or not students sang musical intervals or tapped rhythms in giving answers, whether or not they understood the particular music program and the extent to which assistance was desired in answering lessons of each music program.

From this researcher's observation it was discovered that the computer malfunctioned continually throughout the project. As noted previously, students listened to music examples accompanying each question in the drill through a set of headphones. Often no sound was audible when lessons were attempted. It appeared to this researcher that this problem occurred more frequently in rhythm lessons than in interval lessons. Results from the questionnaire give credence to this observation, where twenty- three per cent of students doing interval lessons said that the sound rarely malfunctioned whereas only ten per cent of those doing rhythm lessons gave the same response. Again, eighteen per cent of the interval group responded that there was no sound "quite often", whereas thirty-five per cent of the rhythm group gave this response.

Concerning the extent to which 'practice units' were used, only twenty-seven per cent of the interval group admitted never having used practice lessons, as opposed to forty-five per cent of the rhythm group. In response to the question 'How often did you sing the interval/clap or tap the rhythm before giving your answer?', fifty-nine per cent of the interval group said they sometimes did so, eighteen per cent did so very often and only fourteen per cent never did so, whereas thirty-five per cent of the rhythm group said they sometimes did so, twenty-five per cent often did so, and a full thirty per cent never tapped the rhythm before answering. These observations will be interpreted later. Both groups gave correct responses in

questions designed to test whether students understood the particular music lesson being used. However, exactly half of the students doing interval recognition did not understand why certain lessons were included, namely, to introduce a new interval. The ability of this particular program to 'teach' is considered later. Furthermore, the fact that students working with this system needed occasional or periodic assistance in doing the drill lessons was evident from student responses (intervals: 87%; rhythms: 90%).

The fourth section of the questionnaire attempted to determine student attitude to group-class instruction, whether or not they understood the instruction, the rate of progress of the class and their ability to maintain pace with the rest of the class. From student responses, it was apparent that language communication was not a problem, despite the unique situation which exists in SWA where the majority of students speak either Afrikaans or German. Most students (70%) thought that the instructor "went neither too slowly nor too fast in the class lessons", while the same proportion felt they could "keep up with other students".

It was stated previously that, if students received ear training instruction from their individual music teachers during this six- month project, results obtained in this comparative study might be invalidated because it would not be possible to determine if student improvement resulted from the specific treatment (see control of variables - Ch. 4.7: History). From the present questionnaire it was ascertained that the majority of students receive ear training instruction from their teachers "only before exams" (70%), while only four per cent stated that they received training "every lesson" or "almost every lesson". Eighteen per cent said they never received this instruction from teachers.

It is interesting to note that the majority of students felt they had benefited from participation in this project (i.e., both CAI and group classes), forty-three per cent stated that they felt their ear training had improved "a little", while fifty-five per cent stated that their aural ability had improved "a lot".

The preference for CAI over group-class instruction was obvious from questionnaire responses (67% preferred the computer, while 21% enjoyed both CAI and classes). Further, sixty per cent said they would be interested in continuing with the computer, whereas twenty per cent would like to continue both CAI and classes.

Regarding the CAMETS tests, more than half of the students found the section on rhythm dictation to be more difficult than the interval recognition section (55%). Further, most students noticed the similarity between pre- and post-tests.

In the final section of the questionnaire, students were given the opportunity of saying something about the purpose of their participation in this project, as well as any other remarks they wished to make. Although difficult to categorise, approximately one quarter of the students answered that the purpose of this study was to improve their ear training ability and to work with a computer. Some of the remarks are given below. The richness of language, pertinence and perceptiveness of the students is evident and therefore these observations are quoted exactly:

"I think it was to see if the computer or teacher trains faster or better"

"so that we will better understand and play music later"

"I was part of an experiment"

"I learned to concentrate more and be more accurate"

"It gave us an idea of a computer, an instrument of the future"

"to see if the computer can replace the teacher"

"It was to show that one can make studie methods in music with a computer. In some respects I think yes"

"This course was to find out if it is worth to let computer help the musicteacher"

"the computer can't shout at me"

"I improved my ears"

"It wasn't nice that the computer sound didn't work sometimes, but I enjoyed it"

"I would have liked to work longer on the computer (for instance 1 hour)"

"I got to know a lot of people"

"The computer was not nice at all"

"I thought that we would learn more of the computer itself"

"It was [more] interesting than ear-training we do during practice lessons. It was my first chance to work with a computer"

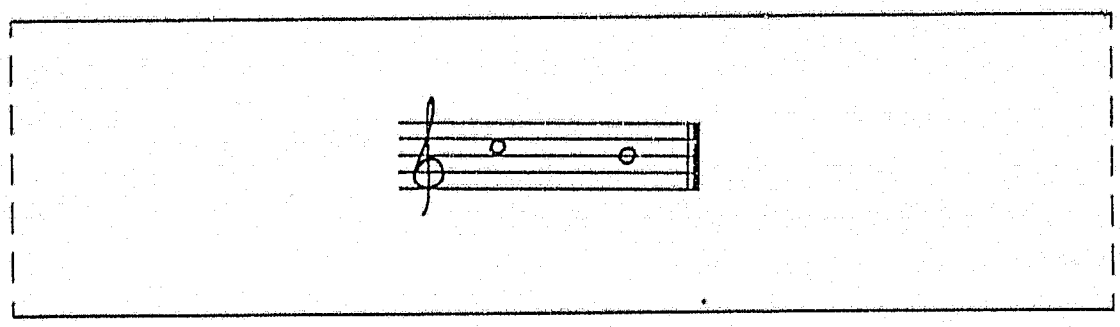
It is noted that students did not write their names on the questionnaires and remained anonymous throughout this study.

7.2 QUESTIONNAIRE : MUSIC LECTURERS

All music lecturers at the Windhoek Conservatoire, the Head of the Conservatoire, music teachers at three schools in Windhoek and lecturers from the Dept. of Music, Academy for Tertiary Education, Windhoek, were invited to attend demonstrations of the Micro GUIDO Ear Training System. Three one-hour demonstrations were given by the researcher during March 1986. In addition, a number of colleagues who had expressed an interest at the beginning of the CAMETS project were given demonstrations at that time.

Following the March demonstrations, music educators were requested to complete a questionnaire to gauge their opinion regarding CAI, the relative merits and limitations of the GUIDO system and approach towards aspects of music ear training instruction in interval recognition and rhythm dictation. Fifteen (out of twenty-five) educators responded to this questionnaire, and their responses are recorded below. In addition, it is noted that the CAMETS face validation questionnaire, sent to authorities at six universities in South Africa, requested responses to a number of items included in the questionnaire sent to music lecturers in SWA. Further, in interviews conducted with the two group-class lecturers by the researcher, responses to all aspects of the present questionnaire were ascertained. Therefore, the descriptive analysis of data which follows includes responses from all these sources. Finally, in interviews with five students not in the sample (see Chapter 8), reactions to these questions were sought and are also included. The questionnaire administered to music lecturers is included in Appendix I.

It is usual for students doing UNISA's Practical Musicianship examinations to consider descending intervals in terms of the first note heard, and identify the interval by assuming this upper note to be the tonic (<u>doh</u>^{1}) of the scale. For example, the interval of



is called a Major 7th, that is, B is the 7th degree of the scale of C major heard below the tonic. The computer, on the other hand, only accepts a response of minor 2nd to this same example, that is, the second (or lower) note heard is taken to be the starting point. In response to a question asking which method should be used in teaching students descending intervals, most educators thought that both methods were feasible, while others argued for particular methods.

Most agreed that both the 'intervallic' and 'tonal' approaches are valid and necessary for total development of aural-perception skills. Four opinions are quoted indicating the diversity of responses:

"If you have a scale and you give it numbers, one to eight, it makes a lot of sense that 'three' remains 'three' whether you hear it above the note or below the note. It is still 'three'... it should still be heard as being that place in that scale" (LG)[36].

"You can't invert an interval and still call it its original name from a purely INTERVAL analysis point of view" (MRSA).

"'Key-awareness' should be encouraged, so UNISA's method is better" (MSWA).

"Although it might be practical to call it a Major 7th, it is wrong and definitely does not sound like a Major 7th. It sounds like a descending minor 2nd. In fact, if the B was to precede the C it would be called a minor 2nd, why should this not apply in this case also?" (MRSA).

It was explained that the computer program is designed so that rhythms (for student dictation) are played on one note i.e., a single note is repeated in a certain rhythm. It was then argued that it is easier to remember a rhythm that has some melodic interest than a rhythm on a single note. Educators were asked whether parameters of music (pitch, rhythm, etc.,) should be compartmentalised in this way, or whether aspects of music ear training should not be broken down into separate components. Most educators agreed that an integration of

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[36] The sources of responses are noted in parenthesis as follows:
MSWA: direct respondents to the 'questionnaire - music lecturers';
MRSA: music authorities at six universities in RSA;
LG: group-class instructors (lecturer-group);
S: students in sample validation study.

pitch and rhythm is ultimately desirable, although separation into components may serve during initial stages of aural development:

"For educational purposes they could be broken down to start with. It would, however, be better if they are brought together again at some stage. In practice there are not many melodies on a single note, and the purpose is to train practicing musicians" (MRSA).

"One should not <u>continue</u> to break up the parameters. There is <u>no</u> defence from grade 5 onwards to continue compartmentalisation, at least, one should gradually integrate all elements" (MRSA).

"It would have been easier, from a teacher's point of view, if melodies could be used in presenting the rhythm exercises" (LG).

"A rhythm on one note is much easier. When you concentrate on the melody, if its ugly or beautiful, it confuses you. It may be familiar, then you think, oh, I've heard that before and you don't think of the rhythm " (S - Grade 6 level).

"It is much easier for me if there is a melody" (S - Gr. 7 level).

It was explained that the GUIDO system is designed to play rhythms without accents, that is, there is no emphasis placed on the first beat of the bar and no sense of pulse. Therefore a 'rhythm' may be notated in any time signature. It is for this reason that the time signature is specified for each rhythm. Educators were asked whether or not they considered this to be a flaw in the computer system. It is noted that eighty-seven per cent of music lecturers in Windhoek thought this was a flaw (MSWA). This concurred with the view held by music authorities in RSA as well as the group- class instructors:

"Unless you feel a <u>pulse</u>, it is contrary to everything you teach a child, that is, the first beat should be stressed. That is fundamental to rhythm. It becomes very sterile and electronic if it is just a series of beeps" (LG).

"Rhythm does not exist of a series of note values in sequence and is very dependent on metrical emphasis" (MRSA).

"I consider it preferable that a sense of pulse is developed before the actual note values are recognised" (MSWA).

"It is unmusical to hear only unaccented rhythms and, I would argue, unrealistic" (MRSA).

"Music devoid of rhythm is not music. Any training programme which ignores this basic fact is flawed" (MSWA).

In response to the question: 'Do you think that ear training is a physical activity, that is, that singing, clapping, beating time, etc., forms an integral part of aural training?', most educators responded affirmatively (93%, MSWA). Among authorities in South Africa (MRSA), one third of respondents disagreed. Both group-class instructors answered affirmatively:

"Yet the physical activity is only a means to an end. If you have to identify a fifth and you can think a fifth, that is the ultimate aim" (LG).

"In my view ear-training is a mental activity, which could be made more interesting by physical activities, such as those mentioned. Ultimately, the recognition is done mentally" (MRSA).

"In theory one should be able to 'visualise', or 'conceptualise' sounds, but in practice the kinesthetic experience seems unable to be divorced from the intellectual. Motoric experience, in my view, assists the student and leads to a more 'musical' approach" (MRSA).

In following and expanding this line of thought, music educators were asked: 'Because the GUIDO computer program in ear-training does not emphasise this physical aspect of ear training (since students need not sing an interval or clap a rhythm), do you consider this to be a major flaw in its approach?'. Here, opinion was divided (Yes: 60%;

No: 40% - MSWA; Yes: 67%; No: 33% - MRSA). Both group-class instructors responded that it is a flaw:

"The ear, and hearing is a physical thing. If you are clapping rhythms and you are singing intervals, you are going to recognise pitch difference and rhythmic values much quicker because you have felt them. The computer presupposes that you do it just aurally" (LG).

"Yes. A physical involvement is critical in the educative process if not also in the testing" (MRSA).

"Although a physical activity, the computer succeeds in bringing forth the same effect, but in a different way" (MSWA).

"I don't think it is a major flaw. There must just be a way to test the student's ear without physical activity" (MSWA).

Educators were asked whether or not they agree that testing a student's ability to write down a rhythm or interval is a valid means of measuring his/her skill in these aspects of music ear training. In both groups (MSWA and MRSA) two-thirds of educators agreed with this statement. Most observed that this form of measuring ability is "one step further than just hearing" (MSWA), that is, it presupposes a knowledge of music theory in intervals and rhythms. Many educators pointed out that this is only one method of measuring ability and that a practical aural examination is just as valid.

Educators were asked whether or not they agree with this statement: 'The whole purpose of rhythm dictation is defeated because the time signature is always given in CAMETS rhythm lessons'. Although this might be viewed as a 'leading' question, one which would increase the probability of biasing the respondent's answer, it was intended to provoke respondents into taking a definite stand. Two-thirds of music teachers in SWA and educators in South Africa disagreed with this statement. However, both group-class instructors responded that this was a flaw in the GUIDO system:

"I think that [time signature given] is a serious disadvantage because all these rather exotic time signatures introduced at a grade 7 and 8 level [in the CAMETS syllabus], that is a notational thing actually. It's not so much an aural-perception [activity]. Whether it's twelve 8th notes, twelve 16th or twelve 32nd notes in a bar, that's only a matter of how you write it. That has more to do with notational theory than with aural training. From the beginning, students should be trained to recognise whether it's duple or triple, just to start" (LG).

"This is correct only if a time signature before rhythmic dictation defeats the purpose - which I feel it doesn't. It rather aids the perceptual qualification of beats in any (given) metric pattern" (MSWA).

"If the student can't hear a rhythm [i.e., pulse], he won't develop a feel for it. If the time signature is already given, it is more like a mathematical problem that has to be solved" (MSWA).

"These [CAMETS] tests seem to be concentrating on rhythm and not so much meter recognition. Candidates should be able to have a feel for meter in any case to do the tests" (MRSA).

"I think it is important for students to be able to recognise time signatures. Possibly this should be incorporated as part of the tests" (MRSA).

The following statement was made: 'It is usual for intervals asked in the UNISA Practical Musicianship examination to be played on the same tonic. Yet the CAMETS lessons in interval recognition at first presents a series of intervals on the same tonic, and then another where the tonic continually changes'. Educators were then asked whether all intervals presented on the same tonic is preferable, the combination of intervals on the same and different tonics as set out in the CAMETS lessons is preferable, or whether all intervals presented on different tonics is preferable. It is noted that <u>all</u> respondents to this questionnaire agreed that the combination of intervals on the same and different tonics was most preferable (MSWA).

Further, the majority of authorities in South Africa concurred with this view (67%, MRSA). One group-class instructor observed that his class found interval recognition far more difficult when the tonic continually changed, than with intervals on the same tonic. Opinions of students in the pilot study was divided. Some felt it made no difference if the tonic moved, others found this section of the CAMETS test particularly difficult:

"Initially the same tonic could be used, but ultimately the purpose is to recognise any interval between any two notes" (MRSA).

"Once your ear is trained for intervals, you should be able to hear them on different tonics" (MSWA).

It is noted that the majority of music teachers in Windhoek would encourage their students to use the CAMETS ear training programmes, if the computer system was made available to them (87%, MSWA). It was obvious from responses that many music teachers felt threatened by the computer system and most of the responses were qualified:

"but not as a substitute for ear-training in which a teacher is involved; rather as an aid" (MSWA).

"Very valuable ear training can be done by the student on his own. The teacher can concentrate on other aspects of music that need personal guidance" (MSWA).

Educators were asked if they considered the synthesised sound, which accompanies the drill lessons in interval recognition on the GUIDO computer system, to be acceptable. Three-quarters of respondents answered that this was acceptable, while the remainder considered a 'piano' sound to be preferable:

"It would be even better if the synthesised tone could be varied; there's such a lot of instruments in an orchestra with different tones and colourings to which an ear should adapt" (MSWA). (It is noted that the GUIDO system permits a variety of 'instruments' which accompany lessons. These are clarinet - the synthesisers normal tone,

sound for rhythm drill, harpsichord, pipe organ, reed organ and bells. However, the 'clarinet' sound was used throughout this project).

"It's the interval that counts and not the sound of the instrument" (MSWA).

"No synthesised note ever sounds like the real thing" (MSWA).

Almost two-thirds of respondents considered the fact that students working with the computer receive all instructions (on the screen) in English, to be disadvantageous for the majority of Afrikaans- and German-speaking students in SWA, especially for younger students. However, it was observed by the researcher that on- screen instructions in English did not prove to be problematic for students participating in this study.

Finally, almost all educators in SWA felt they could personally benefit from working with the GUIDO system to improve their aural skills (93% MSWA).

It is noted that, in the section of the questionnaire permitting additional remarks, many music lecturers and teachers stated that the Windhoek Conservatoire could benefit from this particular computer system:

"As the era of computer-systems has begun and pupils improve their maths, languages and other subjects (which can be ordered), they should have the option to improve their ear-tests" (MSWA).

"I consider the [CAMETS] program to be excellently worked out to take much of the soul-destroying 'donkey-work' out of aural training" (MSWA).

"[The Conservatoire] could benefit a lot from this system and I would like to have it available especially for nervous students with specific problems" (MSWA).

"I think it is an excellent way of aural training. I feel the Conservatoire should invest in a computer for our students" (MSWA).

One lecturer presented an opposing view:

"My generation was taught before the advent of language-labs, etc., so I am prejudiced ... I hate its impersonality. I'm also against junk food!" (MSWA).

Yet, as another educator noted: "Any methodology assisting any effort resulting in noticeable improvement in this dexterity, is to be welcomed. Personal criticism is based on past experiences and should be regarded as, to some extent, partially subjective" (MSWA).

7.3 INTERVIEWS: GROUP-CLASS INSTRUCTORS

Interviews were conducted by the researcher with the two participating group-class instructors separately, at the end of the six- month treatment period. Their points of view regarding the GUIDO computer system have been incorporated in the previous section. In addition, their evaluation of the CAMETS tests and syllabus is made in Chapter 8. The purpose of these interviews was to determine their perception of the research project, teaching methods and group-class instruction. The researcher had observed, from entries made by group-class instructors in the lesson content register, that rapid progress was made in the interval recognition classes, whereas progress in rhythm dictation was very slow. By the fourth and fifth lessons, respectively, each instructor had already completed descending intervals of the major scale. By the seventh and ninth weeks, respectively, the harmonic minor scale had been introduced and by the thirteenth week, both instructors had completed the CAMETS syllabus in Interval Recognition. The remaining lessons were used for revision. In the rhythm dictation class, one instructor appeared to be making rapid progress, since quavers were introduced by the second lesson and semiquaver patterns introduced in simple time signatures by the third

lesson. However, much revision and practice in these patterns was needed and compound duple time (6/8) was only introduced in the eighth week. In comparison, the other instructor introduced new rhythmic patterns far more gradually. Quavers were introduced in the third week, semiquavers in the sixth week and compound duple time in the thirteenth week. It is noted that this more rapid progress was made with students in the younger age group (11-12) than progress made by students in the older age group (13-15).

In the interviews, the instructors observed that rate of instructional progress was made in accordance with the capabilities of the particular class concerned. If the lecturer found that students could easily cope with a particular rhythmic pattern, he immediately pressed on. Both strictly adhered to the CAMETS syllabus: "I followed the syllabus closely, but at the same time I introduced elements as soon as I thought students were coping". Both expressed concern about the rate of progress in rhythm classes: "I was under the impression that the computer group was way ahead".

In commenting on the fact that group classes only reached a grade 3 to 4 level according to the CAMETS syllabus, both instructors noted that the rhythm syllabus had far more content than the interval syllabus: "The interval syllabus is confined to twelve chromatic tones, whereas each additional rhythmic pattern must be regarded as a new concept. You cannot equate a 'four semiquaver' pattern with 'quaver-two semiquavers' pattern. Each is new to the student. You can't say these patterns are the same and that only one new element - the semiquaver - is being introduced". One instructor observed that rhythm dictation was a completely new and 'alien' concept to most students, since it did not form part of music examinations at a grade level. This was stated in response to the observation by the researcher of the slow progress of students in rhythm classes.

Both instructors felt that the half-hour period of group-class instruction was perhaps a bit short, especially for rhythm dictation. Often a new rhythmic pattern would be presented and there was no time to practice it. One instructor observed that two half-hour lessons would have been ideal for rhythm dictation.

Neither instructor used a specific teaching method, such as Kodaly or Solfegge. Both observed that they drew on their teaching experience to teach certain aspects of the course. Use of these and other methods was made as instructors saw fit, provided these methods achieved results. In teaching intervals, one instructor made use of crutches or external aids on occasion, such as the first notes of familiar songs, which may help to identify an interval. The other instructor avoided these aids, stating that aural perception was 'once removed' in this instance: "[it is] an additional step in the cognitive process. It is similar to referring to quarter-notes as crotchets. The student first thinks crotchet and then quarter-note. It should be taught the other way around".

Regarding teaching methods, one instructor observed:

"A teacher will teach according to the experience or exposure he has had to different methods. One would just naturally, selectively, adopt different things in different methods, which the teacher finds effective. Everybody does that. All my lecturers learned from their teachers and I'm learning from them. There is no copyright on that".

Both instructors observed that they directed their teaching towards the average student. They were often aware that certain students were struggling while others were too advanced for the rest of the class. One instructor said he allowed these advanced students to conduct the class on occasion, and that this proved effective in maintaining the interest of these students.

Both lecturers planned the lesson content prior to the lesson, although it was not possible to predict how much would be achieved. Both strived for continuity by recapitulating work covered from the previous week at each new lesson.

Instructors reacted differently to the periodic presence of the researcher as an observer. One welcomed it, stating that all the students knew the observer. He noted that the class seemed to 'try harder' in the researcher's presence. The other instructor felt that the researcher's presence intruded in the instructional process.

"The interaction between me and the class changed. Things seemed different simply because you were there".

Both instructors observed that it would have been preferable if group classes could have continued for a longer period. They suggested three school-quarters, especially in view of the 'ambitious' rhythm dictation syllabus.

These observations by group-class instructors have important implications for the present research and lend support to the statistical findings of the study (q.v. Ch. 9.4 ff.).

7.4 OBSERVATION

7.4.1 OBSERVATION: GROUP CLASSES

It is noted that the researcher attended fourteen group classes (seven of each instructor) during the treatment period. Many of the observations by the researcher have been incorporated in the preceding section. The purpose of these observations was an attempt to describe the 'learning milieu'. This has been defined as "the social-psychological and material environment in which students and teachers work together. The learning milieu represents a network or nexus of cultural, social, institutional and psychological variables. These interact in complicated ways to produce, in each class or course, a unique pattern of circumstances, pressures, customs, opinions and work styles which suffuse the teaching and learning that occurs there" (Parlett and Hamilton 1972, p. 90).

The researcher acknowledges the diversity and complexity of this learning milieu and emphasis on this aspect is beyond the scope of this research. Furthermore, particularly with reference to observation of group-class instruction, it has been noted that the

researcher's presence was keenly felt. Therefore, any attempt to describe the learning situation would necessarily be biased and non-objective. However, it was particularly apparent to this observer that each instructor's teaching style was different. One instructor was quiet-spoken, never shouting or even raising his voice, never showing emotion. The other instructor often shouted and showed agitation and emotion during teaching. One never permitted students to answer unless asked, while the other encouraged a constant interaction between the students themselves. Both commanded respect and enforced strict discipline during classes. One taught in English, the other in Afrikaans. The atmosphere in class was reserved and serious in one case, light- hearted yet serious in the other. One instructor asked questions in a slow-paced manner proceeding around the class in order of seating arrangements, seldom referring to students by name. The other kept up a continuous barrage of questions, fired at individuals at random and always referring to them by name. One lecturer seldom smiled and appeared somewhat dour. Students seemed to be afraid of him. The other joked at times and maintained an electric atmosphere through constant movement, vocal inflection and lively interaction. One was extremely patient with students, the other easily became annoyed and impatient.

The procedures followed in each class were generally similar. The lecturer would explain a concept, usually write it down on the blackboard, present a series of questions at the piano and request students to notate answers. Thereafter, the instructor would ask for each answer in turn from individuals and check whether the rest of the class got the same answer. Occasionally, tests were set and marked by instructors. It was observed that one lecturer made extensive use of harmony in explaining intervals. For example, the minor second ascending was demonstrated in the harmonic context of dominant to tonic with leading note rising a semitone to the tonic. The other lecturer seldom did this. In teaching descending intervals, one lecturer would play the descending scale and omit one note, students being asked to identify the missing note. In rhythm lessons, one lecturer requested that students clap rhythms with the metronome, while the other asked students to count the beats while clapping. Extensive physical activities of singing and clapping were incorpo-

rated in classes by both lecturers. This observation is supportive of the view expressed by music educators that aural training is a physical activity.

7.4.2 OBSERVATION: COMPUTER LESSONS

As noted previously, the researcher was present during a large proportion of student computer lessons. It was observed that students required continual assistance throughout the six-month treatment period. Even towards the end of the project, many students were still unable to operate the programs and overcome problems. It appeared as though some students were not prepared even to attempt to sort out problems. This applied particularly to students in the younger age-group (11 - 12 year olds). Students appeared to be particularly frustrated in overcoming the problem of 'no sound' from the synthesiser. Furthermore, the competency- based nature of the programs increased student frustration. Students required to answer eleven intervals correctly out of a series of twelve attempts, for example, would achieve a score of ten, then make two consecutive errors, whereupon their score would drop to zero. Very few students sang intervals or tapped rhythms before answering, although some appeared to be playing an imaginary piano when answering intervals. It appeared to this observer that students often reached a point of saturation and thereafter tried to guess answers. This was apparent because every time the student touches the screen, a high-pitched beep is heard. An uninterrupted series of these beeps could be interpreted as guessing or 'playing around'. As expected, the novelty of the computer appeared to wear off as soon as students reached a level where answering questions was no longer easy for them.

Finally, many students frequently requested help of a musical nature during the treatment period. The intended logical structure of the CAMETS programs, where new intervals or new rhythm patterns are gradually introduced, was not perceived by many of the students. This

inability of the program to 'teach' will be discussed in the Chapter 9.

8.0 RELIABILITY AND VALIDITY OF THE CAMETS TESTS

It has been observed that the test apparatus used to measure student improvement - the CAMETS tests - forms a crucial part of the present study. The validation procedures referred to previously are now described in detail.

8.1 TEST RELIABILITY

This means that a test is consistent. A test is reliable if the "measurement does not change when the concept being measured remains constant in value" (Bailey 1982, p. 73). Reliability of the CAMETS tests was established by using the procedure known as 'test-retest reliability'. This repeated-measurement procedure provides information about a test's consistency over a period of time.

It has been noted that post-tests were administered on 4 and 5 November 1985. The test-retest reliability procedure was carried out on 11 and 12 March 1986. All students who participated in the CAMETS project were requested to take the exact same test, at the same grade level, as that administered in November 1985. It may be observed that four months had elapsed between the administering of post-tests and re-tests and it may be argued that students are likely to have improved at aural-perception skills in interval recognition and rhythm dictation over this period. Yet it is pointed out that students at the Windhoek Conservatoire had completed their annual music examinations by early November 1985. Further, it can be assumed that students received minimal ear training instruction from their teachers in the remaining month of the 1985 school year (refer to observation by students of frequency of ear training instruction from questionnaire administered to students (Ch. 7.1)). This was followed by the annual six-week end-of-year holiday period (schools re-opened 15 January 1986). Finally, minimal ear training instruction is assumed

to have been received by students during the first six weeks of practical music lessons in 1986, for the same reason as that stated above.

Correlation between test results from the CAMETS tests administered in November 1985 and March 1986 was computed by using the Pearson product-moment correlation coefficient (McCall 1970, p. 116). Although it is acknowledged that this statistical procedure requires scores which represent measurement in at least an equal-interval scale, this condition may be assumed to exist, since each student's post-test score was compared with his re-test score at the exact same grade level. Since the distances between any two numbers on the scale are of known size at any one grade level, an interval level of measurement is assumed to exist, although this is not the case when student scores are compared at different grade levels.

The actual scores obtained in the re-test are given in Appendix L. It is noted that the correlation coefficients between post- test and re-test scores were respectively 0.85 and 0.83 for the interval recognition and rhythm dictation sections of the tests. It is further noted that re-test scores of twelve students were not obtained because these students had either left SWA or were not available for re-testing. Finally, the re-test was administered under exactly the same conditions as both pre- and post-test. The high coefficient of correlation is evident from a perusal of scatter diagrams given in Figure 10 on page 146 and Figure 11 on page 147, and is an indication of the extent to which the CAMETS tests are measuring stable and enduring characteristics of the test takers. From this data it is concluded that a high degree of correlation was obtained from the test-retest reliability procedure. It is therefore argued that the CAMETS tests were consistent and reliable measures of students skill proficiency in the specified aural tasks.

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Name of thesis The use of Computers in Music Education in South West Africa 01163

PUBLISHER:
University of the Witwatersrand, Johannesburg
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