73-29,771

ROTH, Arthur Raymond, 1928-
THE DEVELOPMENT OF A COGNITIVE MUSIC ACHIEVEMENT TEST TO ASSESS HIGH SCHOOL INSTRUMENTAL MUSIC STUDENTS IN MICHIGAN.

Michigan State University, Ph.D., 1973
Music

University Microfilms, A XEROX Company, Ann Arbor, Michigan

THE DEVELOPMENT OF A COGNITIVE MUSIC ACHIEVEMENT TEST TO ASSESS HIGH SCHOOL INSTRUMENTAL MUSIC STUDENTS IN MICHIGAN

By

A. Raymond Roth

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirement
for the degree of

DOCTOR OF PHILOSOPHY

Department of Music

1973

ABSTRACT

THE DEVELOPMENT OF A COGNITIVE MUSIC ACHIEVEMENT TEST TO ASSESS HIGH SCHOOL INSTRUMENTAL MUSIC STUDENTS IN MICHIGAN

By

A. Raymond Roth

This study involves the development of a cognitive music achievement test and its administration to 2714 tenth, eleventh and twelfth grade instrumental music students in Michigan. Eight variables plus a control group were utilized as a basis for comparison of scores.

Procedures

Three pilot tests were constructed and administered to selected students in Michigan, Iowa, Wisconsin and Illinois in the development of the final test. The test items were constructed from a list of objectives determined by Michigan school band and orchestra directors to be logical outcomes of a student's participation in high school band or orchestra. Twenty-three items were aural and twenty-three were visual. The aural items were presented on a pre-recorded tape prepared by the investigator. The entire test was forty-two minutes in length.

During the development of the test, each item was subjected to item analysis techniques to improve the reliability of the test. The reliability of the final test was .80 as determined by the test-retest method utilizing seventy-one students and .81 as determined by the Kuder-Richardson #20 Method utilizing the final test.

The test was administered to instrumental music students in fifty-one randomly selected Michigan high schools in May, 1972.

Hypotheses and Results

1. There is no significant difference in the cognitive achievement of tenth, eleventh and twelfth grade instrumental music students. Rejected.
2. There is no significant difference in the cognitive music achievement of students in the various MSBOA school classifications. Rejected.
3. There is no significant difference in the cognitive music achievement of those students who participate in MSBOA Band and Orchestra Festivals and those whose groups do not. Rejected.
4. There is no significant difference in the cognitive music achievement of those students whose groups rate first division in MSBOA Band and Orchestra Festivals and those whose groups do not. Rejected.
5. There is no significant difference in the cognitive music achievement of students who play instruments in the four separate families. Rejected.
6. There is no significant difference in the cognitive music achievement of those students who have taken private lessons and those who have not. Rejected.
7. There is no significant difference in the cognitive music achievement of those students whose parents, one or both, have participated in a school band or orchestra and those students whose parents have not. Rejected.

8. There is no significant difference in the cognitive music achievement of those students who have taken a formal music theory course in high school or in a summer music camp and those who have not. Rejected.

9. There is no significant difference in the cognitive music achievement of those students who have taken instrumental music in the secondary school and those who have not. Rejected.

In addition to the above results, the test provided further information:

1. It is possible to develop a cognitive music achievement test which will measure many factors, which can be administered in a normal high school class period and which will be sensitive to measure the varying abilities of students.
2. There is considerable variance in the cognitive music achievement of students as shown by a comparison of the mean scores of the fifty-one schools tested.
3. There is considerable variance in the cognitive music achievement, as shown by mean scores of students who form the different populations as determined by the variables.

PLEASE NOTE:

Appendix B has very blurred and indistinct type. Best available copy. Filmed as received.

UNIVERSITY MICROFILMS.

ACKNOWLEDGEMENTS

I am grateful and deeply indebted to:

Cidney, who has been a patient and understanding co-worker throughout this project,

Dr. Robert Sidnell who has provided helpful, thoughtful and stimulating suggestions,

the many members of MSBOA who have, in many ways, assisted in the testing process,

Lisa and Linda who, though too young to understand, provided a certain amount of indifference which furnished a needed degree of balance to our lives.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF GRAPHS

CHAPTER I

THE PROBLEM

Need for Study

Instrumental music in grades K-12 has evidenced enormous growth in the past fifty years. It has progressed from a beginning in which a few schools permitted the teaching of instrumental music on an after-school basis to present practices where the vast majority of schools include instrumental music as an integral part of the curriculum. During these fifty years there has been a tremendous outpouring of effort and money to instruct, equip, maintain and evaluate these instrumental music departments.

The first National Band Contest was held June 5, 6, and 7, 1923. Although its purpose was primarily for entertainment and publicity,[1] in a relatively short period of time such contests, and later festivals, became commonplace and served to provide serious subjective evaluations of performances, both solo and group.

School instrumental music evaluation has shown a similar record of growth in the State of Michigan. Currently thousands of young musicians are involved in solo

---

[1]Emil A. Holz, "The National Band Tournament of 1923 and its Bands," Journal of Band Research, Autumn, 1966, p. 17.

and group festivals. From the results of these festivals it would be possible to develop lists which would show the ratings that individual schools or students have accumulated over a period of years. Although these ratings may be somewhat unreliable in measuring the total musicianship of a student, they would provide a basis for compiling lists of first, second, third, and fourth division evaluations of performances. There is constant evaluation of this type of student musical achievement throughout Michigan.

Benjamine Bloom defines three domains of learning skills as cognitive, affective and psychomotor.[2] If we accept these three domains, it becomes apparent that the current evaluation of musical skills is centered largely with performance skills and, thus, with only one general classification of outcomes. Although some cognitive knowledge is required for these skills, and aspects of the affective may be present, a musical performance can rely primarily upon the psychomotor skill. The evaluation of instrumental music student achievement over the past forty years in Michigan has been, primarily, in these psychomotor skills.

In recent years music educators have placed considerable emphasis upon increasing the amount of cognitive knowledge taught to members of large performance groups.

---

[2]Benjamin Bloom, Taxonomy of Educational Objectives, Handbook I: Cognitive Domain (New York: David McKay Co., Inc., 1956), p. 7.

It has been theorized by many that quality student performance in bands and orchestras will require more than the rote learning of psychomotor skills. This will require knowledge about music which will enhance these student performances and help students to become better all-round musicians, not merely performers. Woodruff states that successful performances are products of four kinds of learning:

> Concepts--of harmony, form, and other things.
> Symbols--notes, signatures, rests, technical terms.
> Motor abilities--muscular performance skills.
> Feelings--likes and dislikes for various musical effects and their influence on choice.[3]

If students are to be given musical experiences which will remain with them and if they are to retain knowledge about music beyond their school years, they will require more than psychomotor skills. Colwell recognizes the importance of cognitive knowledge as a part of the teaching process as he states:

> There is hardly an area of living in which cognition is not important, and though we are prone to emphasize the subjective and emotional nature of music, knowledge is essential to valid experiences with music. Only with knowledge can the emotional response be transformed into the truly aesthetic response, the performer's skills create honest and appropriate interpretations of the composer's intent, the passing musical interest of the public school student be retained as a lifelong pursuit for recreation..[4]

---

[3]Asahel D. Woodruff, "Concept Teaching in Music," in Perspectives in Music Education Source Book III, ed. by Bonnie C. Kowall (Washington, D.C.: MENC, 1966), p. 220.

[4]Richard Colwell, The Evaluation of Music Teaching and Learning (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970), p. 80.

If we are going to teach cognitive skills, we need to evaluate these efforts. Empirical evidence reveals that evaluation occurs, to varying degrees, within individual schools; but no district, regional or statewide programs exist which might inform us as to cognitive knowledge achievement, or any of the factors which affect this achievement. As Bloom states, in reference to the cognitive domain:

> It is the domain in which most of the work in curriculum development has taken place and where the clearest definitions of objectives are to be found phrased as descriptions of student behavior.[5]

Thus the cognitive domain lends itself more readily to observation, analyzation, evaluation and course redevelopment.

However, before this can be accomplished, we need to measure present cognitive music achievement accurately and, hopefully, to determine some factors which affect this achievement. Such a test must be both a reliable and a valid measurement. It must lend itself to ease in scoring and it must be short enough to be administered in one normal high school period of approximately fifty minutes. A test which requires multiple periods for administration is cumbersome to administer and disrupts the normal operation of a school program. In addition, a multiple period test will more likely provide an opportunity for varied student reaction to the testing

---

[5]Bloom, Taxonomy of Educational Objectives, p. 7.

situation and experimental mortality will affect the reliability of the test.

There are few cognitive music achievement tests which fit all of the above attributes and none which is based upon specific objectives determined by Michigan instrumental music teachers.

Over the past decade the Michigan School Band and Orchestra Association has held music education workshops in which problems peculiar to instrumental music are discussed. Considerable time has been spent in developing publications such as the Handbook of Music Theory and Music History and Literature, A Handbook for Rehearsal Enrichment. Both publications were developed as enrichments to band and orchestra rehearsals and are presently in use throughout Michigan. Through these publications the state organization has attempted to effect curriculum changes in individual schools; however, there has been no effort, either on a regional or a statewide basis, to assess student achievement levels in these areas.

The Michigan State Board of Education has made clear its position that all education within Michigan must be organized, delivered and assessed in such a manner that all involved with this process are held accountable for success or failure. It is the board's hope that the implementation of accountability will result in an improvement of educational services to the youth of Michigan. In the preparation of the model for building accountability

the board has indicated six steps to be accomplished by educators. These six steps are:

Step I. Common goals for children

Step II. Performance objectives areas

Step III. Child-school needs assessment

Step IV. New delivery system plans

Step V. Evaluation

Step VI. Recommendations

Steps II and III state more specifically:

> Step II. There are, by common consensus and by definition, certain things it is assumed children ought to know at various stages in their development. This information must now be translated into performance measures. While much work remains to be done, the performance objectives fall naturally into skill areas and attitude-aspiration areas which are, psychologically speaking, in the cognitive domain, the psycho-motor domain or the affective domain.
>
> Step III. Having identified the goals for children, and having articulated the performance objectives for schools, it is necessary to assess the existing relationship between them. This analytical chore must utilize all the knowledge at hand: research, testing, resource distribution and personnel availability and a host of others. The objective is to give local school officials some notion of the variance between desirability of performance objectives and what the child or children can do (needs assessment).[6]

Ralph Tyler stated at the AFRA-NCME symposium in Chicago, Illinois, in February of 1966, in a presentation of the plans for the National Assessment of Educational Progress:

> Because education has become the servant of all our purposes, its effectiveness is of general public

---

[6]Michigan State Board of Education, A Position Statement on Educational Accountability (Lansing, Michigan, 1972), pp. 4-7.

> concern. The educational tasks now faced require many more resources than have thus far been available, and they must be wisely used to produce maximum results. To make these decisions, dependable information about the progress of education is essential, otherwise we scatter our efforts too widely and fail to achieve our goals. Yet we do not now have the necessary comprehensive and dependable data. We have reports on numbers of schools, buildings, teachers, and pupils, and about the moneys expended, but we do not have sound and adequate information on educational results. Because dependable data are not available, personal views, distorted reports, and journalistic impressions are the sources of public opinion and the schools are frequently attacked and frequently defended without having necessary evidence to support either claim. This situation will be corrected only by a careful, consistent effort to obtain valid data to provide sound evidence about the progress of American education.[7]

With the preceding information in mind, the need for a preliminary study of certain cognitive music achievement of instrumental music students in Michigan seems apparent.

Purpose of the Study

The purpose of this study is to assess, through the use of a music achievement test, the cognitive musical knowledge of tenth, eleventh and twelfth grade instrumental music students in the State of Michigan. A secondary purpose is to make comparisons of scores on the basis of eight nominal category variables:

1. Grade in school
2. School classification
3. District band and orchestra festival participation

---

[7] Ralph W. Tyler, "The Objectives and Plans for a National Assessment of Educational Progress," Journal of Educational Measurement, Volume 3, No. 1 (Spring, 1966), p. 2.

4. District band and orchestra festival rating
5. Instrument family
6. Private lessons
7. Previous parent participation in a school band or orchestra
8. Music theory course

This study has been undertaken with the expectancy that the results will help dramatize the need for greater emphasis on cognitive music achievement in instrumental music instruction. It is hoped that such emphasis will assist in causing a greater awareness on the part of Michigan instrumental music teachers of the need for a general musical knowledge by students in our bands and orchestras.

Still another purpose of this study is to develop and pilot test a measure of cognitive music achievement. Since the test used in this research will be available for use following completion of the study, individual instrumental music instructors may wish to administer the test to their own students and to compare the results of their students with those found in this study. This should provide the instructor with a core of knowledge by which he may assess the achievement of his students and give impetus to future improvements and changes within the instrumental music curriculum of his school.

Hypotheses

Although considerable time and effort was expended in developing and validating an instrument for testing purposes, a major thrust of this study was pointed toward the comparison of scores on this test through the use of the eight variables. This list of eight variables was developed by the investigator through consultation with other instrumental music teachers in Michigan. Other variables could have been added to this list; however, machine scoring procedures for this study allowed a maximum of eight variables. Since the control group did not respond to the eight variables, a ninth possibility was added. The hypotheses (stated in null form) are:

1. There is no significant difference in the cognitive achievement of tenth, eleventh and twelfth grade instrumental music students.
2. There is no significant difference in the cognitive music achievement of students in the various MSBOA school classifications.
3. There is no significant difference in the cognitive music achievement of those students who participate in MSBOA Band and Orchestra Festivals and those whose groups do not.
4. There is no significant difference in the cognitive music achievement of those students whose groups rate first division in MSBOA Band and Orchestra Festivals and those whose groups do not.
5. There is no significant difference in the cognitive music achievement of students who play instruments in the four separate families.
6. There is no significant difference in the cognitive music achievement of those students who have taken private lessons and those who have not.

7. There is no significant difference in the cognitive music achievement of those students whose parents, one or both, have participated in a school band or orchestra and those students whose parents have not.

8. There is no significant difference in the cognitive music achievement of those students who have taken a formal music theory course in high school or in a summer music camp and those who have not.

As the study developed, a control group was added which consisted of randomly selected students from the schools tested who had had no secondary school instrumental music experience. A target figure of ten per cent of the treatment group was not realized for the non-music group; however, the findings are reported within this document. Thus, a ninth hypothesis is added:

9. There is no significant difference in the cognitive music achievement of those students who have taken instrumental music in the secondary school and those who have not.

Definition of Terms

In order to clarify later statements, it is necessary to define the use of some terms.

MSBOA--Michigan School Band and Orchestra Association is an organization of instrumental music teachers throughout the State of Michigan. Membership is voluntary and is obtained by the teachers through the office of the Managing Secretary of MSBOA.

INSTRUMENTAL MUSIC STUDENTS IN MICHIGAN--Tenth, eleventh, and twelfth grade students who are members of a band or orchestra in a school which is a mamber of MSBOA.

COGNITIVE MUSICAL KNOWLEDGE--Specific facts that a student has accumulated, and can recall, about music such as: definition of terms, the number of flats or sharps in a specific key signature, interval recognition and music reading. This also includes the ability of aural perception which enables a student to make decisions on the basis of acquired knowledge relative to sound stimuli such as: determining intonation errors of several musical pitches, determining rhythmic errors from a printed score and making other musical decisions which require response to a visual and/or an aural musical stimuli.

GRADE IN SCHOOL--Tenth, eleventh or twelfth grade students in Michigan high schools.

SCHOOL CLASSIFICATION--Classification by MSBOA standards is determined by total high school enrollment. These figures are:

Class AA	1400 or more students
Class A	850-1399 students
Class B	500-849 students
Class C	300-499 students
Class D	299 students or less

DISTRICT BAND AND ORCHESTRA FESTIVAL PARTICIPATION--For purposes of this study, participation is determined if a school has participated in a MSBOA sponsored Band and Orchestra Festival in two of the past three years.

DISTRICT BAND AND ORCHESTRA FESTIVAL RATING--The average rating of the group in MSBOA sponsored Band and Orchestra Festivals in the past three years.

INSTRUMENT FAMILY--Either brass, percussion, string or woodwind instruments used in Michigan MSBOA sponsored festivals.

PRIVATE LESSONS--Those students who have taken ten or more private lessons on a band or orchestral instrument in the past five years.

PARENT PARTICIPATION--Students whose parents, either one or both, have previously played in a school band or orchestra.

MUSIC THEORY COURSE--A course of study which includes music terminology, structure and symbology which is a part of a high school curriculum or a summer music camp program.

TREATMENT GROUP--A population of 2563 tenth, eleventh and twelfth grade students enrolled in a band or orchestra in a randomly selected Michigan school who took the test.

CONTROL GROUP--A population of 141 tenth, eleventh and twelfth grade students from some of the above schools who have not taken band or orchestra in their secondary school experience.

Limitations of the Study

There are no known data at present, which states how many senior high schools in Michigan include either a band or orchestra in their curriculum. Similarly, there is no known data which indicate how many Michigan schools that do include these subjects do not belong to MSBOA.

Empirical evidence does indicate that the vast majority of schools that have a band or orchestra in their curriculum are members of MSBOA. There were 535 such schools in 1972.

Further statements in this study which may refer to instrumental music students will refer only to those whose schools are members of MSBOA. Even though some high schools are organized other than on a 10-12 system, it was decided that this study would use only sophomores, juniors and seniors who were enrolled in a band or orchestra at the time of the test. No attempt was made to test those students who had been members of the school group previously but had not continued in band or orchestra.

Since the testing of fifty-one schools took place over a span of eighteen days, May 8-25, 1972, it was impossible for one person to administer all of the tests. Seven college band members were chosen and trained to perform this task in such a manner that conditions during the testing period would be as similar as possible. Even though strong efforts were made toward this end, it was impossible to duplicate all testing situations in fifty-one separate schools by seven different test administrators.

Part of the original goal was to obtain a control, or non-music, group of ten per cent of the number tested in each school. Plans were made for each test administrator to randomly select the control group from the school office records. Any student who had participated in instrumental music in secondary school would be rejected as a member

of the control group. In actual practice the test administrators were able to obtain a control group in thirty-two of the fifty-one schools. Since the school administrators in some schools did not allow the selection of control group students from the permanent records, the selection process was not random. As an example, in one school, the principal selected the control group from the study hall. The total number of students in this non-music group did not attain the initial size desired and finally became slightly over five per cent of the total tested rather than the ten per cent anticipated.

It will not be within the scope of this study to answer the question of what constitutes music achievement. It is assumed that music achievement is a construct made up of a number of observables and that this study will be concerned with some of these observables.

Although the test instrument was made up of both an aural and a visual part no comparisons, other than statewide means, were made of achievement in relation to each separate part. Many educators agree that aural perception is affected, to varying degrees, by aptitude more than by achievement; however, it is not the intention of the investigator to become involved in this controversy. For purposes of this study the test was treated as a whole.

Scope of the Study

This study has grown in size since the inception of the original project due to the interest and support of

two professional educational organizations: Michigan School Band and Orchestra Association and Michigan Education Association. Since both groups supported the project with grants-in-aid and MSBOA offered the use of facilities in its Managing Secretary's office, it was possible to test a larger number of students. Those tested comprised approximately nine per cent of the total tenth, eleventh and twelfth grade instrumental music student population in Michigan during the 1971-1972 school year. Thus, this large N and the random selection process have provided results which can be generalized on a statewide basis.

Overview of the Thesis

In the following chapter literature and research relating to this study will be reviewed. This will include an historical perspective of achievement testing, four standardized music achievement tests now in use--their description and construction, and a review of some dissertations which have used achievement tests in their studies.

In Chapter III the design of the study will be discussed. This will include the development of the testing instrument, validation and reliability procedures, plus the test administration.

An analysis of the data is presented in Chapter IV with the hypotheses presented in similar order as in this

chapter. An interpretation of the data and the hypotheses plus the inclusion of supplementary data will conclude this chapter.

The fifth and final chapter contains a summary and conclusions. Implications for further research, based upon findings of this study, are presented.

The appendix includes the measuring device, forms used in test development and administration, item analysis, and other pertinent material used in this study.

CHAPTER II

REVIEW OF LITERATURE

Achievement Testing--An Historical Perspective

The adage, "If you wish to know something about a person, just ask him," can be applied not only to personal facts but also to indications of an individual's interests, expectations, aptitudes and achievements. It becomes obvious, by surveying the literature and through personal observation, that there is extensive use of achievement testing in our present-day society. Likewise, a surge of achievement measuring was evident in this country in the beginning third of the twentieth century. However, the search for the origin of the achievement test points to a much earlier date. Ebel reports that an extensive system of written examinations of educational achievement existed in China as early as 2357 B.C. under Emperor Shun. It provided a basis for admission to and promotion in the ancient Chinese civil service and was a part of the merit system which rewarded effort for achievement. This system, which gave the lowliest subject the opportunity to become one of the ruling elite, existed until this century. It was at least partly responsible for maintaining a

society with a high degree of internal stability as well as a relatively high level of culture for over two millenia.[8]

At a much later date the Society of Jesus, founded in 1540, placed a high value upon educational achievement. Rather than utilizing the oral examination method common to that period, they developed a detailed set of rules for the conduct of written examinations which "...apart from the fact that it is in Latin could be used in an examination room today."[9]

The Jesuit influence on testing did not find universal acceptance, for in the middle of the nineteenth century Horace Mann became involved in a controversy over oral versus written examinations. As secretary of the Massachusetts Board of Education, Mann recognized the need for extensive improvement in education. He was troubled over the use of oral examinations because they often degenerated into sessions in which unhappy students chose the occasion to settle differences with the schoolmaster.

Mann felt the need for more objective evidence of pupil achievements and listed the following advantages of written examinations:

---

[8]Robert L. Ebel, Essentials of Educational Measurement (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972), p. 5.

[9]James Petch, "Examinations," Encyclopedia Brittanica, 1960, VIII, 937.

1. More evidence concerning the achievement of each pupil could be obtained.
2. A written report of those achievements would be produced.
3. Each pupil would be asked the same questions; thus, all would be treated alike.
4. There would be less possibility of favoritism for, or bias against, particular pupils or teachers.[10]

Through Mann's influence the oral examinations began to disappear and be replaced by written examinations. Today, except for the oral examinations given by some colleges to graduate students upon completion of their work, the written examination is used for achievement testing.

Ebel regards Edward L. Thorndike as the "father of modern educational measurements."[11] Thorndike was the author of the first textbook in educational measurement which was published in 1903. Evidently the book fulfilled a need in the field but was not sufficiently understood by students, for Thorndike states in the preface to his second edition, "In fact, an elementary introduction to the theory of mental measurements, treating the simpler general problem in the logic of quantitative thinking, is needed now more than ever."[12]

---

[10]Ebel, Essentials of Educational Measurement, p. 7.

[11]Ibid., p. 11.

[12]Edward L. Thorndike, An Introduction to the Theory of Mental and Social Measurements, 2nd ed. (New York: Teachers College, Columbia University, 1913), p. vii.

In this book little attention is given to the philosophy and theory of measurement; rather, elementary statistical and computation aids are offered to the student. Discussion centers about such basic measures as central tendency, distribution, variability, frequencies, relationships and correlations, plus the use of tables, graphs and formulas. By present standards the book would be of limited value but, for its time, the book's contribution to educational measurement was far-reaching.

The work of Thorndike was soon followed by other attempts to measure systematically the outcomes of various subjects in the school's curriculum: Stone's arithmetic test in 1908, Courtis's arithmetic computation test in 1909, Thorndike's handwriting scale in 1910, the Ayres Handwriting Scale in 1911 and the Hillegas Composition scale in 1912.[13]

The first state-wide achievement testing program was initiated by New York in 1865 and was known as the Regents examinations.[14] Although the early Regents examinations were designed primarily as screening tests for college admission, in later years the tests became broader evaluation instruments. Another achievement test series given on a state-wide basis was the Iowa Every Pupil Tests,

---

[13]Henry Chauncey and John E. Dobbin, Testing, Its Place in Education Today (New York: Harper and Row, 1963), p. 12.

[14]Ebel, Essentials of Educational Measurement, p. 8.

begun at the University of Iowa in 1929.[15] These tests began as an academic contest in which local winners moved on to regional and finally to state contests. Often high-scoring students in the state contest were awarded scholarships for their achievement.

Testing of even larger groups of subjects took place during World War I. When the United States entered the war, the Army requested the American Psychological Association to help devise a method for classifying recruits according to their mental ability. Two tests were developed and given to over two million soldiers: the "Army Alpha Test" and the "Army Beta Test" (a test designed for illiterates which utilized drawings and non-verbal materials). The "Army Alpha Test" was a good test instrument to choose promising officer candidates, to assist in the assignment of recruits with different intellectual skills, and to reject those who lacked sufficient mental ability for the service.[16]

The use of achievement, aptitude and psychological tests for large groups has been commonplace in the twentieth century. In recent years colleges have shown great interest in students who score high marks on such tests as the Scholastic Aptitude Test, the National Merit Scholarship Qualifying Test and others. Project TALENT,

---

[15] Ibid., p. 16.

[16] Chauncey and Dobbin, Testing Today, p. 7.

a program intended to provide nationwide data on the aptitudes, achievements, backgrourds and career plans of secondary school students, was supported by the United States Office of Education, and tests with accompanying surveys were administered to approximately one-half million students in March, 1960.[17]

One of the most recent developments in large group achievement testing is the National Assessment of Educational Progress. The development of NAEP was brought about when a number of individuals concerned about education were searching for comprehensive and dependable data to use in answering questions regarding the progress of education in this country.

After numerous discussions and conferences, John W. Gardner, President of Carnegie Corporation, asked a number of individuals to form a committee, known as the Exploratory Committee on Assessing the Progress of Education, chaired by Ralph Tyler. This committee was given three charges: (1) to explore ways in which a national assessment of educational progress might be structured in order to provide needed information without harming present educational efforts, (2) to develop methods and procedures

---

[17]Ebel, Essentials of Educational Measurement, p. 24.

to secure such information, and (3) to suggest the makeup of a group which would implement such a plan.[18]

A large number of professionals and laymen was involved in identifying important educational objectives in the ten subject areas to be assessed: literature, science, social studies, writing, citizenship, music, mathematics, reading, art and vocational education. In selecting the objectives, three criteria were used: (1) the objectives should be those which scholars in the field feel are worthwhile, (2) the objectives should be those which schools are currently attempting to attain, and (3) the objectives should be those which thoughtful laymen consider important for youth to learn.[19]

The plan was to assess approximately 130,000 individuals using the following subdivisions: male and female, race, two socio-economic levels, four age groups (9, 13, 17 and young adults between the ages of 26 and 35), four geographic locations, and four different types of communities.[20]

---

[18] J. C. Merwin and F. B. Womer, "Evaluation in Assessing the Progress of Education to Provide Bases of Public Understanding and Public Policy," Educational Evaluation: New Roles, New Means, The Sixty-eighth Yearbook of the National Society for the Study of Education, Part II (Chicago, Illinois: The University of Chicago Press, 1969), pp. 305-334.

[19] Carolyn Hightower, How Much Are Students Learning?, Report from the Committee on Assessing the Progress of Education (Ann Arbor, Michigan: November, 1968), p. 7.

[20] Ibid., p. 18.

The assessment began in 1969 with the testing of three subjects--science, citizenship and writing. The remaining seven subjects consisting of literature, social studies, music, mathematics, reading, art and vocational education were tested in the following two years. It is planned to continue the cycle so that constant evaluation of educational achievement may take place and results may constantly be updated.

Published Music Achievement Tests

It is obvious that the number of music achievement tests is constantly changing with new tests being developed while others fade in use and are dropped from print. Investigation by the writer indicates a need for more testing instruments inasmuch as it is often difficult to find more than one published achievement test available for a specific purpose, such as cognitive music achievement on the secondary level.

Elementary Music Achievement Test

Richard Colwell has developed a series of four music achievement tests for grades 3-12 which are intended to measure certain basic skills in aural perception.[21] These tests have been developed over a period of four years and require some two hours and twenty-five minutes for the entire battery. They have been constructed so that

[21]Richard Colwell, Music Achievement Tests (Chicago: Follett Publishing Company, 1965).

a teacher may give all parts at the same time or may administer them individually at the teacher's convenience.

Content validity was established by the use of objectives stated or implied in textbooks and curricula along with consultations with leading educators. Colwell does not attempt to establish concurrent validity between student scores and teacher ratings because he calls teacher ratings "notoriously unreliable."[22] Reliability of the MAT is generally high (between .85 and .91) with the reliability of the subtests being somewhat lower.

All tests utilize a 33-1/3 rpm record with aural stimuli provided by piano, violin, viola and cello. The following areas are covered within the battery of tests: pitch, interval, meter and mode discrimination; feeling for tonal center; pitch and rhythmic auditory-visual discrimination; tonal memory; melody, pitch and instrument recognition; musical style; auditory-visual discrimination; chord and cadence recognition.

In the opinion of this writer the MAT is the best available comprehensive music achievement test for use within grades 3-12. In the Buros Seventh Mental Measurement Yearbook Lehman suggests that the tests are useful for:

1. assessing the progress toward meeting the curriculum objectives
2. program evaluation

---

[22]Richard Colwell, "The Development of the Achievement Test Series," Council for Research in Music Education, No. 22 (Fall, 1970), p. 59.

3. student guidance
4. group diagnostic work
5. identifying students who may profit from instrumental instruction.[23]

Watkins-Farnum Performance Scale

A contrasting test for instrumental students is the Watkins-Farnum Performance Scale[24] for it measures musical achievement objectively through individual performance. The test is not designed for a specific grade level but rather it measures a student's performance level on a band instrument. The scoring is accomplished in the following manner: (1) the examinee plays the exercises from the test booklet, (2) the examiner marks the errors within measures, (3) the final score is determined by the number of correctly played measures.

Although the reported reliability is high, it is somewhat open to question since it involves a personal decision on the part of the person scoring the test. Validity coefficients, based upon teacher ratings with a small number of subjects, vary from .68 to .87.

There are several disadvantages with the test:

1. What constitutes an error is an individual

---

[23]Oscar Krisen Buros, Mental Measurements Yearbook, Seventh Edition (Highland Park, New Jersey: The Gryphon Press, 1972), p. 248.

[24]John G. Watkins and Stanley E. Farnum, Watkins-Farnum Performance Scale (Winona, Minn.: Hal Leonard Music, 1954).

judgment despite the attempt by the authors to give clear instructions.

2. The test requires large segments of time for it must be administered individually.
3. Since the statistical data is incomplete, published norms are unavailable.

The test has been developed from one objective: to be able to determine different levels of achievement through performance. It is a serious attempt to solve the age-old problem of objectively measuring musical performance, which is highly subjective in nature.

Aliferis Music Achievement Test

The Aliferis Music Achievement Test[25] measures students' ability to make auditory-visual discriminations of melodic, harmonic and rhythmic examples at the college entrance level or at the end of high school. While many other tests require several class periods for administration, the Aliferis Test can be administered in forty minutes.

The test is entirely aural inasmuch as the stimuli are provided by piano and have been prepared on tape. The test items were devloped from a search of freshman theory and harmony books plus consultation with music instructors. The materials are separated according to melody, harmony, and rhythm. On this basis, Aliferis

---

[25]James Aliferis, Aliferis Music Achievement Test (Minneapolis: University of Minnesota Press, 1954).

claims content validity. Predictive validity is obtained by correlating test scores to college course grades earned during four years. Generally high coefficients prevail with the highest correlation shown in music theory grades (.66) and the lowest in performing organization grade. Reliability coefficients vary from .67 to .84 with the combined figure of .88 for all three test sections.

Each of the three elements of music (melody, harmony and rhythm) is presented as an element and as an idiom. The element is presented to depict the smallest unit out of musical context. The idiom presents each of the elements in a context by grouping two or three elements so that the example is closer to a practical musical experience.

The rhythmic section of the test contains examples which have included melodies to the rhythms. The author states that these were added so as to avoid "the tapping of rhythms, a procedure in conflict with the declared objective of creating musical test items."[26]

Extensive norms are given in the test manual for various grades, types of institutions and different geographic regions. Such data offers teachers, counselors, administrators and students the opportunity to make numerous comparisons of scores, locally, regionally, institutionally and nationally on the basis of the Aliferis Test.

---

[26]James Aliferis and James E. Stechlein, "The Development of a College Entrance Test in Music Achievement," Journal of Research in Music Education, No. 2 (Washington, D.C.: Music Educators National Conference, 1953), p. 88.

Snyder Knuth Music Achievement Test

The Snyder Knuth Music Achievement Test was developed from a Doctoral Thesis, "The Development, Construction and Standardization of a Test of Musical Achievement" by Alice M. Snyder.[27] The purpose of the study was to develop an instrument which would measure general college elementary educations students' acquired knowledge and skill in certain aspects of elementary school music. It was designed as a test to screen those students who are knowledgeable in basic music fundamentals. An arbitrary cut-off point (at the 55th percentile) is suggested for those students to be enrolled in an elementary music methods course.

Test items were constructed from material derived by analyzing the content of several elementary music series textbooks. Equivalent forms of the test were prepared, each containing four parts: (1) Listening and Seeing, (2) Listening, (3) Analogies or Music Comprehension, and (4) Recognition of Familiar Melodies. There is a question as to the equality of the equivalent forms, for the mean score for Form A is 75.5 while the mean score for Form B is 82.5. The piano provides the musical stimulus and the entire test, including directions, is tape recorded. A filmstrip which is required for test administration presents

---

[27]Alice M. Snyder, "The Development and Standardization of a Test of Music Achievement" (Unpublished Ph.D. Dissertation, University of Oregon, 1958).

the potential problem of coordinating the tape and filmstrip. The need of a darkened room may likewise be a hindrance in test administration.

A pre-pilot test was administered to Dr. Snyder's classes. She utilized the piano as the sound stimuli for items while students listened, watched notation in the test booklets and marked the answer sheets. Content validity is claimed by the test constructor and, although no statistical evidence is available, the claim appears justified. Reliability is reported as extremely high (.99+). Both Gordon and Colwell state that an obvious error was made in computation;[28] therefore, no accurate reliability estimate is available.

Norms were derived from 311 elementary education majors at San Francisco State College. Certainly this is a small number of subjects on which to base norms. Both Slagle and Garder report mean scores from nine to sixteen points lower than Snyder.[29]

As is true with so many achievement tests, the test has strengths along with weaknesses, but it is the only one which measures achievement for this specific purpose. It is evident that additional tests of music achievement are needed to establish outcomes in a variety of areas.

---

[28]Buros, Mental Measurements Yearbook, pp. 250-251.

[29]Ibid., p. 251.

Studies Involving Music Achievement Tests

Colwell

Colwell reports a study conducted in the Sioux Falls, South Dakota, Public Schools in which he compared music achievement among approximately 4000 vocal and instrumental students in grades five through twelve. No hypotheses were used in the study, for the purpose was to evaluate objectively the skill of auditory-visual discrimination achievement in students. The study utilized the Aliferis Music Achievement Test, the Farnum Music Notation Test and the Knuth Achievement Tests as measuring instruments.[30]

Results consistently showed that students whose background included a variety of musical experiences were superior in achievement, even when the amount of time spent was equal. Instrumental students were superior except that vocal students with piano training were superior to instrumental students without piano training, and instrumental students with piano training scored highest of all. It must be noted, however, that the intelligence quotients of the above groups corresponded directly to the achievement levels; therefore, we must raise the question of whether training or intelligence produced the greatest effect upon achievement. The author of the study did not address himself to this point. Another factor which may

---

[30]Richard Colwell, "An Investigation of Musical Achievement Among Vocal Students, Vocal-Instrumental Students and Instrumental Students," Journal of Research in Music Education, Volume 11 Fall, 1963, pp. 123-130.

have affected the results of this study is the fact that since the instrumental music was entirely elective, it may have attracted the better students.

Some interesting supplementary information was provided through the study. It was found that the amount of individual practice was not a factor in achievement as measured by the Knuth Tests. Further information indicated that at the end of the summer months students had retained almost all of the music knowledge acquired the previous school year. In the high school level little or no improvement was shown on the test as a result of an additional year's training in music. Instrumentalists gained only slightly while vocal students actually declined.

Although not stated specifically by Colwell, the most significant factor in achievement seemed to be private piano lessons taken by students in all levels.

Finally, Colwell concluded that Kwalwasser's statement that "training attracts the talented" is true and that musical aptitude is not so important as other factors in predicting musical achievement.

Iltis

A somewhat different achievement test, constructed by John Iltis,[31] measured the ability of high school

[31]John L. Iltis, "The Construction and Validation of a Test to Measure the Ability of High School Students to Evaluate Musical Performance" (Unpublished Mus. Ed.D. Dissertation, Indiana University, 1970).

students to evaluate musical performance from short taped examples of wind ensemble literature which contained performance errors. Students were asked to make judgments of the example within five categories: intonation, tone quality, interpretation, ensemble and technique. Similar responses were made by professional musicians and teachers and the results were compared.

Several problems were evidenced in the development of this test. The use of subjective words or phrases to describe a musical performance, or even a single tone, produced differences of opinion and some confusion. Item difficulty was a problem, although improvement seemed to be apparent as the test was developed. Furthermore, the attempt to provide three levels of adjudication provided for greater lack of objectivity. Dr. Iltis found that preparing taped examples of purposeful errors by trained musicians is extremely taxing and difficult.

A questionnaire provided Iltis with information regarding individual students and the opportunity to hypothesize from these reponses. Over a period of time 1637 students took either a part of or the entire test.

On the basis of this study the following conclusions were reached:

1. There is a positive relationship between amounts of performance experience and the ability to evaluate musical performance.
2. Some types of instrumentalists are better able

to evaluate musical performance than others. In this case, double reed players excelled.

3. Students with broader performance backgrounds are more sensitive to performance evaluation.
4. Students with more education are more sensitive to performance evaluation.
5. There is a positive relationship between the number of years of private music study and the ability to evaluate performance.
6. The number of years of instrumental experience is positively related to the ability to evaluate performance.

This investigator, on the basis of data from this study, has formed conclusions similar to points 2, 4, and 5 above.

Swinchoski

If an achievement test is to be a good test which is usable, it must be both valid and reliable. The Swinchoski Standardized Music Achievement Test Battery for the Intermediate Grades[32] is an example of a test which is valid but contains low reliability. Extensive effort was made in securing the content of music education progams through recommendations of leading authorities in the field, through the investigation of a number of textbooks in use, and through a survey of some 135 courses of study.

---

[32]Albert A. Swinchoski, "The Development of a Standardized Music Achievement Test for the Intermediate Grades" (Unpublished Ph.D. Dissertation, University of Kansas, 1963).

The test was designed with four subtests: rhythmic activities, listening activities, creative activities and music reading; with each subtest containing twenty to twenty-two multiple-choice items for fourth, fifth and sixth grade students. All items are presented aurally by tape and four regular class periods are required for administration of the test. Two of the disadvantages of testing on four separate days are the possibilities of varied reaction to testing and fluctuation in the size of the population.

A stratified random selection of schools in the mid-western and western states provided twenty schools for the test. Since all materials required mailing and all tests were administered by the classroom teacher, the test constructor lost control of the testing situation. The study also included a survey of teacher preparation in music and the amount of classroom time devoted to music.

Coefficients of reliability were low for individual subtests and ranged from .23 to .48. Combined coefficients of the four tests produced somewhat higher figures: .59 for fourth grades, .67 for fifth grades and .74 for sixth grades. This would indicate the possibility that the test was too difficult for younger students, yet the mean item difficulty index was 38.3 which would indicate difficulty that was too low to provide for successful discrimination. Evidence points to the fact that, had the test constructor spent more time using item analysis

techniques and redesigning test items, the final result would have been a test which contained higher reliability. Items were not functioning properly to discriminate consistently the high students from the low. Alice Snyder, in her doctoral thesis, indicates the need for a proper balance of analyzation of data plus observation as she states, "This experience proved to the writer the futility of trying to judge the difficulty of an item on its face value without test results to balance one's personal judgment."[33]

Mansur

Paul Mansur was intrigued by the amount of time required to audition instrumental students in performing groups. He set out to develop an objective measurement which would make a valid selection using only a fraction of the time normally involved for the person holding the auditions.[34] As the basis for the study he used students chosen for the Oklahoma All State Band versus those who auditioned and were not chosen.

A pilot test of fifty multiple-choice items was developed covering four factors which Mansur felt were contributors to success in musical performance achievement: (1) knowledge and understanding of musical terms, (2) experience

---

[33]Snyder, "Music Achievement Test," pp. 43-44.

[34]Paul M. Mansur, "An Objective Performance-Related Music Achievement Test" (Unpublished Ph.D. Dissertation, University of Oklahoma, 1965).

and familiarity with composers, (3) experience and familiarity with music literature, and (4) the ability to analyze musical notation. An attempt to correlate scores with audition ratings was unsuccessful, as some students with relatively low test scores received excellent audition ratings while some who received high test scores received low audition ratings. It is interesting to note in this test and all succeeding tests that either the percussionists were excused from the test or all their test papers were rejected.

Following the unsuccessful pilot test a new test was developed utilizing printed musical examples and requiring students to make judgments about tempo, articulation, dynamics, phrasing, style, rhythm or tonality. In addition, four unmusical situations were devised and presented. All test items required that the students accept or reject a choice. This new test was given to the Oklahoma All State Band with some improvement in reliability. Attempts to establish validity were unsuccessful due to a lack of responses by mail. A validity coefficient of .64 is reported but it must be regarded as spurious as only sixty per cent of the validating population responded.

A final revision was called the "Wind Instrument Inventory Scale" and consisted of eighty items which required twenty minutes to complete. Once again, it was administered to those auditioning for the Oklahoma All State Band. There were several contaminating factors in the administration of the test, the most serious being the fact that

forty-nine students had taken the test the previous year. However, due to the improvements in the test, the study operated more efficiently as Mansur was able to reject the null hypothesis on the basis of the results. It stated that there is no significant difference between the means of a performance-related achievement test administered to students nominated and accepted for membership in the Oklahoma All State Band and to students nominated but not accepted for membership. Although the "Inventory Scale" lacks validity and contains low reliability, it is a serious attempt to develop an objective measurement for audition purposes. The study certainly indicates that more research would be worthwhile in this area; however, the possibility of evaluating the psychomotor domain by testing cognitive judgment is questionable.

Folstrom

Considerable controversy has arisen in recent years over the value of the study of music in high school performance groups. Critics of performance groups declare that the general level of musicianship is relatively low because rehearsals often lead only to "playing or singing notes" rather than to a thorough understanding of the composition. Supporters of performance groups contend that students involved in these organizations do, in fact, attain a certain level of achievement and that these groups are the most successful generators of music training in our entire music curricula. Roger Folstrom addressed

himself to this controversy in "A Comparative Study of the Musical Achievement of Students in Three Illinois High Schools."[35] In the study he evaluated the degree of musical achievement of performance groups over a nine month period; compared these groups with control groups (randomly selected groups of non-music students); compared the results between different schools involved in the test; and, finally, compared differences in the areas of melody, harmony and rhythm.

He chose the Aliferis Music Achievement Test: College Entrance Level as the testing instrument for the following reasons: (1) validity, (2) reliability, and (3) adaptability to the testing situation.

The testing procedure involved administering the test to both treatment (students in performing groups) and control groups during the opening weeks of school and again to the same students during the closing weeks of school. A total of 496 students from three high schools was involved in the test.

The results of this study indicated that students from performance groups scored significantly better than students not involved in any school band, orchestra or choir. This indicates that a learning situation existed and, in addition, all treatment groups showed a gain over a nine-month period. It is interesting to note that the

---

[35]Roger J. Folstrom, "A Comparative Study of the Musical Achievement of Students in Three Illinois High Schools" (Unpublished Ph.D. Dissertation, Northwestern University, 1968).

greatest difference in means, of all the schools, existed in the area of rhythm. Results further indicated that musical achievement differed significantly between schools. Other factors which showed a possible effect upon musical achievement were socio-cultural level of the community, student grade level, and student interest in out-of-school musical participation.

The most serious problem in this study was participation. Initially, approximately 2000 students were to be included in the study; however, due to a number of circumstances, the final N was 496.

Summary

The previously mentioned studies are but a part of the process of evaluating musical achievement. Even though much time and effort have been devoted toward this end, greater endeavor is needed in the future. However, our greatest effort must be placed in a slightly different area--the application of knowledge acquired through research. The following comments by Robert Ebel are appropriate as a conclusion to the survey of literature in this study:

> What can we learn, apart from the facts, by viewing this perspective on the history of measurement in education? Perhaps that the problems of educational measurement are persistently perennial--that the problems of what to measure and how to measure it, of objectivity, reliability, validity, and efficiency that bothered our predecessors still bother us. Perhaps that those predecessors were remarkably inventive and resourceful in discovering some solutions to those problems. Perhaps that we owe a great debt to the dynamic innovators who saw a need, and who then committed enough time, effort, persistence, and

skill to create the tools and establish the agencies that could satisfy the need. Perhaps that our technical skill in developing tools, procedures, and agencies has been greater than our pedagogical skill in getting teachers to make effective use of our the available technology. If teachers could only be taught and persuaded to use well the technology of educational measurement that has already been developed, there could be a quiet revolution in the quality of our testing and teaching almost overnight.[36]

---

[36]Ebel, Essentials of Educational Measurement, p. 27.

CHAPTER III

DESIGN AND ADMINISTRATION OF THE STUDY

Development of the Testing Instrument

Planning the assessment of the population of tenth, eleventh, and twelfth grade instrumental music students in the State of Michigan provided the investigator with a number of problems:

1. If the test were to be statewide, what would be the mechanics of the test?
2. How many schools and students would be involved?
3. What instrument would be used in the testing?
4. What information would be measured by the test?

Fortunately, the president of the Michigan School Band and Orchestra Association became interested in the project and asked the author to present a preliminary proposal to the executive board of that organization. The Board decided to supply printing, secretarial and mailing services for the project. Furthermore, the Board requested and received from the Michigan Education Association a sizable research grant which was applied in support of the statewide test. With such support it was evident that the scope of the project could be widened so that a fairly large sample of the population of instrumental

music students could be measured and, using a randomized selection technique, it would be possible to generalize on a statewide basis.

One of the first decisions to be made was the selection of an achievement testing instrument. First and foremost, the test would have to be valid for measuring Michigan high school instrumental music students. The second consideration was that the test would have to be the right length. Since it would be administered to many schools throughout the state, it seemed impractical to utilize more than one class period for administering the test. A greater degree of cooperation could be expected from the school administrators and music directors if the test could be given during a single band or orchestra period and would not interrupt the normal operation of the school day. A test which would fit the above criteria was unavailable; therefore, it seemed advantageous to develop a test which would not exceed forty-five minutes in length. Such a test would be less reliable than one of twice the length, but some reliability was sacrificed for greater participation from the selected schools. The final test, which was administered to fifty-one schools, was designed for greater usability at a negligible sacrifice of reliability.

A music achievement test which can be administered in less than sixty minutes provides the constructor with a dilemma: Should the test be a cursory examination of many musical factors or should it examine a small number

of factors in depth? An in-depth examination of a few factors will likely provide greater reliability, but the question remains whether music achievement measurement can be based upon a small number of factors. Conversely, a test which contains a few items on each of many factors will likely result in lower reliability but should provide the examiner with more knowledge relative to the total musical achievement of the examinee. It was decided to adopt the second procedure.

Test Construction, Pilot Test No. 1

Tests are built upon objectives, curriculum objectives, objectives from textbooks or from consultation with well-known educators within the field. Gronlund speaks of test construction and objectives when he states:

> The first order of business, then, in constructing an achievement test is not the construction of test items, but rather the identification and definition of learning outcomes to be measured. These should logically grow out of the instructional objectives of the course in which the test is to be used. The sequence of steps for determining outcomes is as follows:
>
> (a) Identify the instructional objectives of the course.
> (b) State the objectives in terms of general learning outcomes.
> (c) Under each objective list the specific learning outcomes you are willing to accept as evidence of the attainment of that objective.[37]

In many cases, schools do not have specific objectives stated for all courses, music curricula differ from one

---

[37]Norman E. Gronlund, Constructing Achievement Tests (Englewood Cliffs, N.J.: Prentice-Hall, Inc. 1968), p. 5.

school to another and some directors do not use specific textbooks in their bands and orchestras--how does one construct an achievement test for all these groups? The approach was to ask the music teachers to provide opinions as to the course content of band and orchestra classes which they felt to be important. This information would provide a basis for the development of the test. Ebel confirms this direction when he suggests:

> Publishers of standardized tests of educational achievement and directors of wide-scale testing programs that use achievement tests face the special problem of how to make a single test suitable for students who have been taught by different teachers using different textbooks and learning materials in courses having different orientations. The usual solution is to base the test on elements thought to be most commonly taught.[38]

Over a period of time this investigator compiled a list of forty testable objectives which are possible outcomes of instruction in band and orchestra classes in Michigan schools. The objectives were constructed on the basis of personal observation, experience, consultation with other instrumental music teachers and the content of the two MSBOA handbooks on music theory and music literature. This list was given to music directors at a spring MSBOA meeting with instructions to respond to each of the objectives according to a weighted scale. The directors were given the opportunity to make additions to the list.

---

[38]Ebel, Essentials of Educational Measurement, pp. 57-58.

The results were tabulated and the top twenty objectives were used as a basis for writing test questions. See Appendix A for the list of these objectives and the weighted scale for each objective.

At this point it became necessary to determine the type of test questions to be used in the test. Multiple-choice items offered the best alternative for the following reasons:

1. The effect of guessing by students is minimized.
2. Multiple-choice questions can be adapted to measure almost any educational learning.
3. If items are constructed carefully, there is less likelihood of ambiguity within items.
4. Multiple-choice items are easily scored.

Ebel sums up the status of the multiple-choice test when he states: "Multiple-choice test items are currently the most highly regarded and widely used form of objective test item."[39] Cronbach reports that multiple-choice items offer the opportunity to test the ability of the student to generalize data.[40]

Item Construction

A total of seventy items was constructed by the investigator and constituted the first item pool.

---

[39] Ibid., p. 87.

[40] Lee J. Cronbach, Essentials of Psychological Testing (New York: Harper & Brothers, 1949), pp. 278-279.

Music is an aural art; therefore, this author felt that any testing instrument involving music achievement should include items which would require the student to make decisions based upon musical aural stimuli.

The next problem was to develop some type of recording which would present the aural portion of the test efficiently and correctly. It was decided to utilize a prerecorded tape because better fidelity of sound could be accomplished in the administration of the test using a portable tape machine rather than a portable disc machine. With the use of the recording studio of station WFBE in Flint, including their high quality recording equipment and an excellent engineer, a tape could be produced which would be of the highest quality.

Since the population to be tested was comprised of band and orchestra students the author decided to utilize instruments from these groups rather than electronic sound sources in the preparation of the tape. Although using electronic instruments would provide an easier method for constructing errors, utilization of band and orchestra instruments would provide the medium in which students perform, thereby establishing one form of content validity for the test. It was this point, however, which caused great difficulty in the preparation of the tape. Trained musicians react on the basis of their preparation. This came to light in recording sessions, for:

1. Trained musicians find it very difficult to play planned errors.

2. When playing a planned error, trained musicians often change the quality or timbre of their tone, thereby causing a second and unwanted error.
3. Trained musicians find it difficult to sustain a satisfactory degree of planned intonation error.
4. Trained musicians attempt to make decisions concerning the degree of error which can and should be made only by the test developer in conjunction with the recording engineer.

These points, plus the author's inexperience in determining the degree of discrimination required for a good aural test item, caused many lengthy and tedious recording sessions. Unfortunately, correct judgments in tape preparation come only from actual recording experience and gaining such experience is time-consuming.

Administration of Pilot Test No. 1

The pilot test, consisting of twenty-four visual and twenty-six aural items, was constructed from a pool of questions which had been developed from the previously mentioned objectives. During July, 1971, it was administered to 230 students at the summer music camps at Ferris State College and Michigan State University. The students' responses were placed upon machine scored answer sheets (see Appendix F), and were processed through Evaluation Services at Michigan State University.

Data Analysis, Pilot Test No. 1

An item analysis of Pilot Test No. 1 provided the following information:

Table 1.--Distribution of Item Difficulty and Discrimination Indices.

Item Difficulty Indices		Discrimination Indices	
81-90	1	61-70	2
71-80	9	51-60	3
61-70	10	41-50	13
51-60	3	31-40	11
41-50	8	21-30	6
31-40	3	11-20	6
21-30	9	00-10	7
11-20	4	Less than 00	2
00-10	3		
Mean Item Difficulty 47		Mean Item Discrimination 31	

Other information on which was provided by the item analysis included:

Mean Score of Test	26.52
Standard Deviation	6.34
Kuder Richardson Reliability #20	.77
Standard Error of Measurement	3.04
N = 230	

In interpreting the above data, primary consideration was given to item difficulty, discrimination power and point biserial correlation. An indication of a target figure for the first two is given by Gronlund:

> Other things being equal, we should favor items at the fifty per cent level of difficulty and those with the highest discriminating power. However, the tentative nature of our data requires that we allow for a wide margin of error. If an item

> provides a positive index of discrimination, if all of the aternatives are functioning effectively, and if the item measures an educationally significant outcome, it should be retained and placed in an item file for future use.[41]

Although the mean item difficulty neared fifty, it was obvious that a number of items had difficulty indices which were too low while, at the opposite end, a number of items were high in difficulty. Two items had both difficulty and discrimination indices of less than seven. Five items contained a difficulty index of above seventy while the discrimination index was ten or below. In addition, there were two items which had negative discrimination indices. Since all of the above items were in the aural portion of the test, it was evident that the greatest concentration of effort in refinement should be applied in this area. See Appendix B for data relative to difficulty and discrimination for the complete test.

The frequency distribution indicates a normal distribution of scores with approximately two-thirds of the scores falling one standard deviation on each side of the mean. The standard error of measurement is well within the expected error stated by Gronlund in the following table:

---

[41]Gronlund, Constructing Achievement Tests, p. 88.

Table 2.--Expected Error of the Standard Error of Measurement.

Number of Items in the Test	Standard Error
Less than 24	2
24-47	3
48-89	4
90-109	5
110-129	6
130-150	7

Source: Gronlund, Constructing Achievement Tests, p. 88.

Test Construction, Pilot No. 2

Through personal observation and analyzation of the data, it became obvious that refinements were needed for Pilot Test No. 2. A number of ambiguities in the pre-recorded tape seemed to provide items with excessively high or low difficulty and too many items which contained low discrimination indices. In the first recording session the musicians were asked to replay musical examples which were to be heard twice on the tape. They found it virtually impossible to play even the simplest passage exactly the same two times. This problem was solved by recording many examples for each test item, selecting the most valid example and dubbing the tape where more than one performance of the same example was required.

The order of the test was changed from visual-aural to aural-visual thereby providing more continuity in that students who finished before the time limit on the

visual part would not have to wait for resumption of the test. Twenty minutes for completing the twenty-four visual items proved too long so the time limit was reduced to fifteen minutes. The test was also shortened from fifty to forty-six items.

The visual appearance of the test booklet was improved through better reproduction methods, more space between items, and clearer written examples on the music staves. Other refinements included improved terminology, better distractors for some items, an attempt to vary the difficulty of some items, and dropping some items while adding others.

Administration of Pilot Test No. 2

It had been decided at an earlier date to make a random selection of schools in Michigan for the final tests. Therefore, so as not to contaminate the selection, it was decided to try to obtain a population outside Michigan to test Pilot Test No. 2. A national American School Band Directors Association Convention provided the author with the opportunity to search for several schools to serve as the testable population for Pilot Test No. 2. The search was successful and North High School and South High School in Sheboygan, Wisconsin; Collinsville High School, Collinsville, Illinois; and Boone High School of Boone, Iowa were chosen to form the pilot population.

The new pre-recorded tape, the restructured test of forty-six items, the answer sheets plus instructions for administration of the test were sent to the four schools in late fall of 1971. Pilot Test No. 2 was administered to 424 students by the four directors in December and all materials were returned to the author in January, 1972.

Data Analysis, Pilot Test No. 2

The answer sheets were again processed by Evaluation Services at Michigan State University. An item analysis provided the following information:

Table 3.--Distribution of Item Difficulty and Discrimination Indices.

Item Difficulty Indices			Discrimination Indices	
81-90	4		71-80	2
71-80	10		61-70	3
61-70	7		51-60	1
51-60	9		41-50	7
41-50	6		31-40	11
31-40	4		21-30	5
21-30	3		11-20	11
11-20	2		00-10	4
00-10	1	Less than	00	2
Mean Item Difficulty 56			Mean Item Discrimination 31	

Other information which was provided by the item analysis included:

Mean Score of Test	20.13
Standard Deviation	5.63
Kuder Richardson Reliability #20	.72
Standard Error of Measurement	3.00

N = 424

The mean item difficulty rose some nine points on this test while mean item discrimination remained the same. In general, the visual portion of the test functioned well inasmuch as only one item contained an obvious low discrimination index. See Appendix C for data relative to difficulty and discrimination for all items on the test. Again the aural portion provided the greatest concern, for there still remained two negative discriminators and four items with an index between 00 and 10. A slight improvement was shown in the standard error. A frequency distribution table (see Appendix C) reveals less variability on this test with a greater concentration of scores one S. D. from the mean.

The well-informed personal observation is one of the most valuable tools in the kit of the researcher. Van Dalen supports this view and states:

> Some theories are evolved in a less formal manner. Many investigators believe that an undue, premature concern with ordering facts and structuring highly formalized theories may cause them to terminate their exploratory activities too soon and may blind them to other facts and ordering possibilities. To them, a theory is a provisional tool They place less emphasis on elegant conceptualizations and logical-deductive procedures and more explicit emphasis upon observation and data-oriented explanations. They believe that the interaction of

> observational and conceptual processes is necessary for scientific progress.[43]

The need for such interaction became evident during the period of analyzation of data on Pilot Test No. 2. The following points came under scrutiny during this period of observation and analyzation.

1. For the most part, the items in the visual part of the test were functioning well as test items.
2. The drop of mean score of almost six and one-half points was attributed to the greater selectivity of students in Pilot Test No. 1 for they were members of summer music camps. Furthermore, both camps provided a required music theory course as a portion of the camp curriculum. This alone should provide a basis for a higher mean score.
3. It was determined that a number of items on the aural portion of the test were too difficult, indicating further need for greater refinement in the pre-recorded tape.
4. Ten per cent of the testees omitted three or more test items which would indicate some problem in test administration. There was

---

[43]Deobold B. Van Dalen and William Meyer, Understanding Educational Research (New York, N. Y.: McGraw-Hill, 1962), pp. 64-65.

little or no control over this fact since the individual band directors administered the test to their own students.

Test Construction, Pilot No. 3

With the above information in mind Pilot Test No. 3 was redesigned. Another pre-recorded tape was constructed during a new recording session at the same studio and with the same musicians as for the previous pilot. Through experience in developing tapes the investigator realized that the use of college or advanced high school musicians was superior to the use of professional musicians for recording purposes. First, their sound more closely approximated the sound common to the students to be tested. Second, they were more willing to allow the test constructor to initiate decisions regarding the construction of a tape with planned errors.

The format of the test was again improved with even more space between items and with musical examples written by a professional copyist. Each section which dealt with a new factor was begun with a heading and the action portion of each item was included in the form of written instructions so that the student would both hear the directions on the tape and read the directions on his test booklet. The test was typed by a professional typist and copies were printed at the University of Michigan Copy Center in Ann Arbor. The test booklet was now in its final form and ready for Pilot Test No. 3.

Administration of Pilot Test No. 3

The problem of choosing a group to test for the final pilot was solved by making the statewide random selection at this time and choosing a school which was not selected for the actual test administration as the school for Pilot Test No. 3. This test was administered in March, 1972, to Flint Northwestern High School and the results once again provided the basis for an item analysis by Evaluation Services at Michigan State University.

Data Analysis, Pilot Test No. 3

Table 4.--Distribution of Item Difficulty and Discrimination Indices.

Item Difficulty Indices			Discrimination Indices	
81-90	7		81-90	1
71-80	6		71-80	1
61-70	14		61-70	4
51-60	9		51-60	2
41-50	3		41-50	11
31-40	3		31-40	8
21-30	2		21-30	7
11-20	2		11-20	6
00-10	-	Less	00-10	5
		Less than	00	1
Mean Item Difficulty 60			Mean Item Discrimination 34	

Other information which was provided by the item analysis included:

Mean Score of test	18.18
Standard Deviation	6.36
Kuder Richardson Reliability #20	.78
Standard Error of Measurement	2.96
N = 111	

A frequency distribution table (see Appendix D) revealed a larger variability of scores on this test and, as can be seen, the scores did not produce a normal curve due to predominancy of low scores and an abnormal spread of higher scores. Through observation and analysation it was felt that the abnormal central tendency was caused by the testing population rather than by the test itself. The standard error once again made slight improvement. Both difficulty and discrimination mean indices were higher than previous pilots although one negative discriminator still remained. Items in the visual portion of the test were reacting well to analysis which indicated that a change in this area was unnecessary.

Test Construction, Final Test

At a final recording session seven items were re-recorded. One fact was apparent during the preparation of these tapes--the slightest variation in performance at the wrong instant can produce unwanted results. The greater degree of discrimination required greater finesse in preparation.

The final test consisted of forty-six items, twenty-three of which were visual and twenty-three of which were aural. The aural items utilized the pre-recorded tape and required twenty-five minutes for completion. Discounting the time required to place the information required for the variables on the anwer sheet, the test proper required forty-two minutes for administration.

Both the test booklet (see Appendix D) and the tape were now in final form. In preparation for the final test, ten copies of the original tape were dubbed at the studio of Station WFBE. Four thousand copies of the test booklet were printed at the University of Michigan Copy Center in Ann Arbor. Four thousand answer sheets obtained from the Scoring Center at Michigan State University completed the materials needed for the administration of the test.

Random Selection of Schools

The random selection process was made by choosing schools on the basis of random numbers. A list of 225 random numbers from 1 to 999 was printed by computer at the University of Michigan-Flint (see Appendix E). The 1971-1972 list of senior high schools which were members of MSBOA was numbered from 1 to 535. The first number on the random list was 746 and was rejected because it was greater than 535. The second number was 207. The corresponding number on the MSBOA membership list provided the initial school for the testing list. This process continued until a list of seventy randomly selected schools had been constructed.

Following the random selection process, letters were sent to the band and orchestra directors of the first sixty schools chosen stating that their school had been selected randomly and requesting participation in this statewide test (see Appendix F). The additional ten

schools were held in reserve should a significant number of the first sixty not participate, but none was needed. The second and third weeks of May were selected as the target period for administration of the test. This segment of time was deemed the most advantageous, for it was somewhere between the state band and orchestra festival and the close of school. Two weeks gave directors some latitude in working around concerts or other planned activities which could not be changed. A self-addressed return postcard was included in this letter (see Appendix F) with the directions that it be returned within five days. Also included in this mailing was a note to the principal requesting his cooperation in the study (see Appendix F). A follow-up telephone call was required for those directors who did not return the enclosed postcard. Approximately forty per cent of the sixty schools were called in this manner. An exceedingly high degree of cooperation was shown on the part of these schools, for fifty-seven of the sixty schools contacted responded positively to the query. For various reasons, six of the directors in the fifty-seven schools later found that their groups would be unable to cooperate in the testing. The six schools were not similar in size or location, indicating a random dropout.

A second letter providing information relative to the test and its administration was sent to the band and orchestra director in each of the fifty-one schools

(see Appendix F). It was in this letter that a control group was requested (five to ten per cent of the total number taking the test from each school) to take the test along with the instrumental music students. The control group was to be randomly selected from the entire school student population of tenth, eleventh and twelfth graders. Any student who had had band, choir or orchestra experience in junior or senior high school would be rejected. A self-addressed postcard was included in this mailing (see Appendix F). On the card the director was requested to indicate how many separate bands or orchestras would be tested, what time the classes met and which days would not be available for testing in his school. The vast majority of schools had only one group to test or combined two groups into one period. In the actual administration of the test, forty schools required one test period, six required two test periods and five required three test periods. As for the previous mailing, additional telephone calls were required to accumulate all of the information.

The stage was now set for the scheduling of the fifty-one schools within the two week testing period. A highway map of the State of Michigan was placed upon a bulletin board with the location of each of the schools indicated by a colored pin. It then became a matter of mechanics in coordinating class meeting times with distances between schools. In an effort to save expenses, every effort was

made to schedule two schools in one day per test administrator or two schools which could be reached by two administrators traveling in one car. Overnight accommodations for test administrators also became a determining factor in scheduling, again due to the expense involved.

Two consultants at the Testing Bureau of the Michigan Department of Education suggested that the author train test administrators rather than attempt to send all materials by mail and ask each music director to administer the test to his own students. The latter method would result in loss of control of the testing situation; therefore, seven college students who were actively involved in instrumental music were trained as test administrators. This method would give maximum assurance as to the uniformity of the testing situation in all cases.

The seven that were selected as test administrators were members of the University of Michigan-Flint Wind Ensemble. The students were briefed as to the scope of the study, their duties and their part in the administrative process. Later a training session was held in which all attended and participated. The following forms (see Appendix F) were distributed and discussed.

1. "Check List for Test Administrators". This was a list of duties for each administrator from the time he arrived at the school until he left.
2. "Checklist of Materials". This was designed so the administrator might check the materials

he would need for the testing before he entered the school. Additional materials such as an extra tape, extra pencils, power cord, etc. were listed, hopefully to meet any normal situation.

3. The "Variables". These were to be read to the students by the test administrator before the test began so that they might correctly mark their answer sheets.
4. The "School Information Sheet". This was to be filled out by the test administrator during the test and to be included in the envelopes containing the completed answer sheets.
5. Mark sense scoring sheets, Form 0-7928, from Michigan State University.

Following this discussion, a trial testing situation was held in which the author acted as the test administrator while the students actually took the test. Following the test, additional discussion was held to assure unanimity of understanding toward the testing situation. Each student was then given an ample supply of materials plus the schedule to follow for the succeeding weeks.

Administration of the Final Test

During the period of May 8th to May 25th, 1972, the test was given to fifty-one schools by seven test administrators who traveled a total of 5521 miles. Thirteen individual overnight accommodations were required during this period. No more than five test administrators were

testing at one time. Five Wollensack portable tape recorders were used to provide the stimuli for the aural part of the test. Ten copies were made of the original pre-recorded tape so that each administrator had two tapes at all times. The testing ran very smoothly during the seventeen days, for but one long-distance phone call was needed to solve a last-minute emergency. Since only tenth, eleventh, and twelfth grade students were to be tested, some directors were confronted with the problem of what to do with the ninth grade students in their bands or orchestras. This situation was handled in a variety of ways and on only four occasions did the ninth graders actually take the test. The test administrator collected these answer sheets separately and marked them so that they were not processed by Evaluation Services. Each of the four directors was provided with an answer key at a later date which allowed him to hand score the tests of his ninth grade students.

Processing and Analyzing the Data

The answer sheets from each individual school were kept separately and were taken to Evaluation Services at Michigan State University. The tests were scored on the Op Scan 100 Optical Scanner and the responses to each item, the variables and the mean score of each individual student were placed upon computer cards. In addition, an item analysis printout was secured for each school plus an item analysis for the combined

population of 2714 students from the fifty-one schools. See Appendix H for information relative to the test results of the individual schools. These schools have been ranked in order of raw mean score. Appendix H also includes the following information: K. R. #20 reliability, number of students tested, standard error of measurement, high and low score, standard deviation and whether or not a control group was obtained from that school.

With the aid of the Consultation Service of the Department of Education and models 3600 and 6500 of Data Control Computers at Michigan State University, extensive data were accumulated and are presented in the following chapter. Nine one-way Analysis of Variance programs provided data for the eight variables plus the control versus treatment comparison. Four Post Hoc Scheffé Multiple Comparison Techniques were used for the four variables which contained more than a yes-no response. A two-way Analysis of Variance with Fixed Effect Model provided information between grade and classification variables while a similar analysis was completed between the variables of private lessons and instrument. A Three-Way Analysis of Variance with Fixed Effect Model provided information relative to the interaction of the district rating, music theory course and private lesson variables. In addition, Factor Analysis programs rotating eight, eleven, fourteen, fifteen, seventeen and eighteen factors were also completed.

Validity

For any test to be worthwhile it must be valid; i.e., it must measure what the constructor has set out to measure. This statement is somewhat unscientific for it relies to varying degrees upon the judgment of the person who constructs the test. Cronbach states:

> No matter how complete the test author's research, the person who is developing a selection of classification program must, in the end, confirm for himself the validity of the tests in his particular situation. And the person who is evaluating a training program must determine the content validity of the tests for his program.[44]

The author claims validity of this test on the basis of three factors: (1) The test is constructed from objectives which instrumental music teachers determined were important outcomes of the students' band or orchestra experience, (2) the items on the test make up a number of observables which are a part of the construct of cognitive music achievement, and (3) the pre-recorded tape which is used as a stimulus for the aural portion of the test utilizes actual band and orchestra instruments for all examples. The author recognizes that there are other dimensions in the construct of cognitive music achievement which were not measured by this test.

Achievement tests are often constructed from objectives stated in textbooks, opinions of well-known educators, curricula or course objectives. However,

---

[44]Cronbach, Psychological Testing, p. 105.

what is stated by or from the above may not, in reality, correspond to what is actually being taught in the classroom: This final responsibility is in the hands of the individual teachers. Thus, this test has greater validity than those which are constructed from the above-mentioned objectives, for the constructor has gone to the primary source--the classroom teacher--for information upon which to base the construction of this test. Band and orchestra directors selected the objectives they considered to be the most important as logical outcomes of a student's participation in band or orchestra. It may be argued that what teachers say is important and what they actually teach may not be the same; however, it may be argued further that their opinion is much closer to what students are actually learning in their classrooms than opinions of sources removed from the classroom.

As previously mentioned, it is not within the scope of this paper to define music achievement; however, it is logical to assume that cognitive music achievement consists of a number of observables which are measurable. The combination of observables within a particular domain is a construct. Although all observables of the construct of music achievement were not measured by this test, the fact that some were measured and that they are a part of the construct of music achievement lends construct validity to the study. Nunnally confirms this viewpoint when he states:

> Because constructs concern domains of observables, logically a better measure of any construct would be obtained by combining the results from a number of measures of such observables than by taking any one of them individually. . . . Thus any particular measure can be thought of as having a degree of construct validity depending on the extent to which results obtained from using the measure would be much the same if some other measure, or hypothetically, all the measures, in the domain had been employed in the experiment. Similarly, the combined scores from a number of measures of observables in the domain can be thought of as having a degree of construct validity for the domain as a whole.[45]

The instruments which were used in the construction of the pre-recorded tape were flute, oboe, clarinet, violin, viola, cello, trumpet, French horn, trombone and snare drum. Thus the sources of the aural examples are those which students use and are familiar with from their band and orchestra rehearsals.

Reliability

A good test must not only be a valid measure of the subject but also must be consistent. It is difficult to determine a specific degree of reliability required for a test. Many authors do not give specific figures but state that reliability limits may well vary due to such factors as the use of the test, the number of subjects tested, the length of the test and others. Therefore, it is wise to treat reliability within each test and what may be quite reliable in one situation would not be sufficient in another.

---

[45]Jum C. Nunnally, Psychometric Theory (New York, N.Y.: McGraw-Hill, 1967), p. 86.

Two methods were used to determine reliability of this test: Test-retest and Kuder Richardson #20. The aural portion dictated, to some degree, what types to use and what not to use. When recording errors of live instrumental performance, it is virtually impossible to obtain parallel forms. Split-half was likewise discarded as a measure of reliability for this test because of the multiplicity of factors tested within the forty-six questions.

Kuder Richardson #20 was used throughout the development of the test as one measure of reliability. The following table will show the progress of the three pilot tests:

Table 5.--Reliability of Pilot Tests.

	N	Reliability	Mean Score	Standard Deviation
Pilot No. 1	230	.77	26.52	6.34
Pilot No. 2	424	.72	20.12	5.63
Pilot No. 3	111	.78	18.18	6.36

The population of Pilot No. 1 included students from two summer music camps in grades eight through twelve. The fact that these students were voluntarily enrolled in a summer music camp which required a sizable fee would indicate a somewhat abnormal population. This is evidenced by a

substantially smaller variability in this group when compared to the scores of the population in Pilot No. 3. The population of Pilot No. 2 consisted of four widely separated high school bands, grades nine through twelve, from small to medium-sized towns in Illinois, Iowa and Wisconsin. The bands of an urban high school, grades ten through twelve formed the population for Pilot No. 3. All three pilot groups were chosen primarily because of their availability.

Throughout the development of this test it was evident that the aural portion required more refinement and redesigning than the visual. Often items which appeared as valid questions during the recording sessions later performed poorly in the actual testing. The construction of aural perceptive items using live performers is quite difficult, for it requires an "inexact" person to produce an "exact" degree of error. The judgment and observation of the constructor are of extreme importance.

These points came to light when an item analysis was run on the twenty-three aural items of Pilot Test No. 2 and the reliability was found to be .29 while the reliability of the twenty-three visual items was .76. After a careful redesigning of taped items and re-recording of the tape for Pilot Test No. 3, the figure rose to .44 and .79. Following Pilot Test No. 3, seven items were re-recorded for the final test. Two additional item analyses were run following the final test on items one through twenty-three and twenty-four through forty-six. The results

indicated a reliability of .63 for the first twenty-three items and .76 for the second twenty-three items while the reliability was .81 for the combined portions of the test.

The second method used for determining reliability was the Test-retest method. Seventy-one tenth, eleventh and twelfth grade students were tested with an intervening period of two weeks. Table 6 is useful in comparing the two tests.

Table 6.--Test-retest, Reliability.

	N	Mean Score	S. D.	K. R. #20	S. E. M.
Test	76	24.77	6.30	.76	2.96
Retest	71	26.07	6.24	.76	2.98
Reliability of Test-retest		.80			

Using the formula $r = \frac{\Sigma(z_1 \times z_2)}{N}$ the computed reliability was .80 which compares favorably with .81 with the K. R. #20 of the master test. It is the opinion of this author that in light of (1) the length of the test and (2) the multiplicity of factors tested by the test, the above reliability is the best that can be expected. Leonhard and House, in summarizing opinions regarding degrees of reliability, state that: ".80-.84 Fairly high: of some value in individual measurement and highly

satisfactory for group measurement."[46] In light of all factors this test is the most valid and reliable for the purpose which it has served--to measure large groups of instrumental music students in cognitive music achievement.

Factor Analysis

Seemingly, the most inconclusive evidence of the entire study was derived from the attempt to arrive at a successful factor analysis of the final test. Six factor analysis programs were run at the Computer Center at Michigan State University rotating eight, eleven, fourteen, fifteen, seventeen and eighteen factors. Of these six runs, the seventeen factor analysis provided the highest loadings on the individual factors and is shown in Appendix I. In addition, empirical observation determined the seventeen factor rotation to be closer to the factors measured by the test. By comparing the intercorrelation matrix in Appendix I with a list of factors, by item, prepared by the author in constructing the test one can readily see a low correlation. As an example, items ten, eleven and twelve of the final test are items which all require the listener to determine how many measures contain rhythmic errors or if all are played correctly. None of the six factor analyses provides this similarity of these three items. Closer analyzation will provide one with similar

---

[46]Charles Leonhard and Robert W. House, Foundations and Principles of Music Education (New York: McGraw-Hill, 1959), pp. 341-342.

problems throughout the forty-six items. The facts that the final test is multi-factored and that the construct of music achievement depends upon many factors would lead one to expect that no factor analysis would show conclusive results on this test.

Therefore, this seemingly inconclusive evidence may be quite conclusive, for it points to the complexity of cognitive music achievement and the difficulty of measuring it accurately with a single test. This fact is brought to light by consideration of the previously mentioned items ten, eleven, and twelve. Although, on the surface, these items are measuring rhythmic achievement, another factor or factors may be present. It is obvious to this investigator that it is difficult to isolate any one single cognitive musical factor. This difficulty is compounded when one attempts to measure many factors, of which some are likely interacting with each other, in determining the construct of cognitive music achievement.

CHAPTER IV

FINDINGS OF THE STUDY

Introduction

This chapter is a presentation of the findings of this study. The frequency distribution of the statewide test will be presented. Following this, the format will be: the statement of each hypothesis, data and discussion relative to that hypothesis, and finally a rejection or a failure of rejection for each hypothesis. Also included will be data collected from 2 two-way and 1 three-way analyses of variance between variables of grade in school, school classification, music theory course, private lessons and instrument family. The chapter will close with supplementary findings resulting from the study.

Level of Significance

Since each individual is used eight times with the variables, the alpha level is therefore cumulative. To split up the alpha level and to help account for this fact, 0.005 will be used as the level of significance.

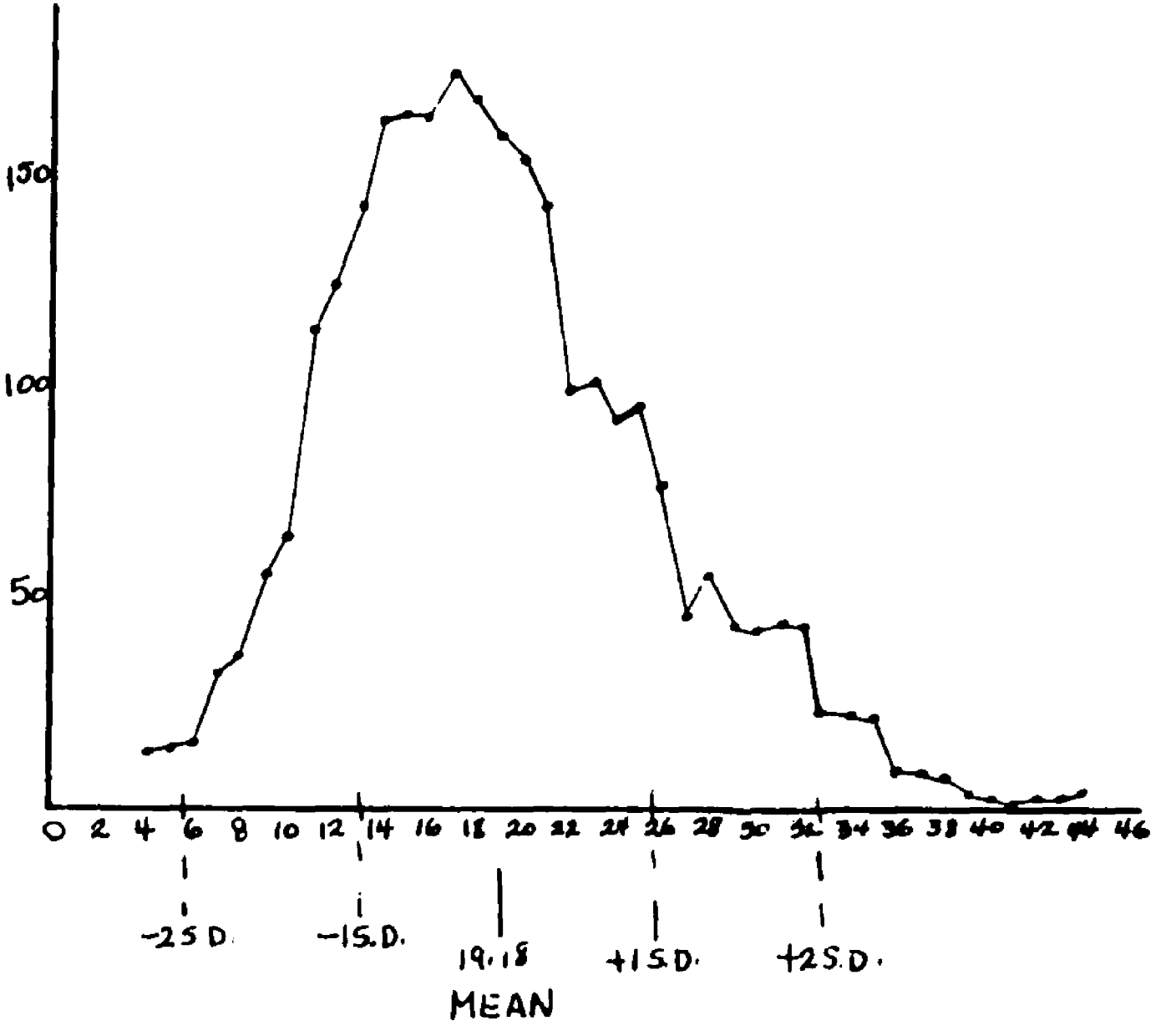
Frequency Distribution, Statewide Test

Table 7 provides the distribution scores of the total population tested, both treatment and control groups. An investigation of the entire deck of 2714 computer cards

revealed ten on which an excessive amount of information was missing. These were dropped from the study but are included in the frequency distribution in Table 7 and summary statistics of Table 7a. It should be noted that of the remaining population of 2704 students, the treatment group numbers 2563 and the control group 141. Some students did not respond completely to the question relative to the variables; therefore, the total N of 2563 will not be reached and the total will differ in the summary statistics of each of the first eight hypotheses.

The distribution of scores approximates a normal curve, skewed positively, which indicates a few relatively high scores. This can be observed in Table 7a which shows that twenty-six of the total 2704 scored in the ninety-ninth percentile. Their scores ranged from forty-four to thirty-eight. This situation, plus a high frequency of low scores, has caused both the mode and median to be smaller than the mean. Since the test is rather difficult and the lower scores of the control group are included in this distribution, it is not surprising that the mean is somewhat low. The standard deviation is slightly larger than any of the previous three pilot tests, thereby signifying a more heterogeneous population. Table 7a indicates the frequency of raw scores and the percentile rank of the entire population.

Frequency Distribution, Statewide Test



N = 2714
Mean = 19.18
Median = 18.33
Mode = 17
S. D. = 6.79

Table 7a.--Summary Statistics of Statewide Test.

Raw Score	Frequency	Percentile Rank
44	3	99
43	2	99
42	3	99
41	2	99
40	4	99
39	4	99
38	8	99
37	10	98
36	10	98
35	22	97
34	24	97
33	23	96
32	44	94
31	45	93
30	44	91
29	44	90
28	57	88
27	47	86
26	78	83
25	97	80
24	93	77
23	102	73
22	100	69
21	134	65
20	144	60
19	160	54
18	168	48
17	176	42
16	166	36
15	167	30
14	165	23
13	143	18
12	127	13
11	113	8
10	76	5
9	48	3
8	26	1
7	22	0
6	5	0
5	3	0
4	3	0
0	2	0

Hypotheses Tested

Hypothesis 1. There is no significant difference in the cognitive music achievement of tenth, eleventh or twelfth grade instrumental students.

Table 8.--Summary Statistics of Variable--Grade in School.

Category	N	% of Population	Mean	S. D.
Tenth Grade	1184	47	18.58	6.19
Eleventh Grade	799	32	20.07	6.74
Twelfth Grade	528	21	21.49	7.42
Total	2511	100	19.67	6.74

Table 8 indicates a nearly equal improvement of 1.5 points per grade. Although the meaningful difference is small, the test does indicate differences across these years. Since the populations of eleventh and twelfth grades become much smaller it may be theorized that the weaker students are dropping out, leaving only the better students in the twelfth grade. On the other hand, it could also be theorized that the stronger students are dropping out because of schedule conflicts or lack of interest. If either supposition were correct, a smaller S. D. should develop; however, the larger S. D. indicates both suppositions are incorrect since both weaker and stronger students remained, causing greater variability among scores. Likewise, if the majority of weaker students remained, the

mean score would become lower and, conversely, if the stronger remained, a higher mean score would result. Therefore, since both weaker and stronger students remain, the findings indicate that there may be some justification for hypothesizing a gain in cognitive musical achievement across grades.

Table 8a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Grade in School.

Source of Variation	d.f.	Mean Square	F	p. less than
Grade in School	2	1644.81	37.29	0.0005
Residual	2508	44.10		
Total	2510			

Table 8b.--Scheffé Post Hoc Method of Multiple Comparisons Mean Differences (x-y)

	Eleventh Grade (y)	Tenth Grade (y)
Twelfth Grade (x)	1.43*	2.91*
Eleventh Grade (x)		1.49*

*Denotes significance at < 0.005 level.

The Scheffé Post Hoc Method indicates that there is a significant difference between eleventh grade and twelfth grade, between tenth grade and twelfth grade and also tenth

grade and eleventh grade scores. Therefore, on the basis of the above information: Hypothesis 1 is rejected.

Hypothesis 2. There is no significant difference in the cognitive music achievement of students in the various MSBOA school classifications.

Table 9.--Summary Statistics of Variable--School Classification.

Category	N	% of Population	Mean	S. D.
Class D	123	5	17.94	5.82
Class C	688	27	17.55	5.38
Class B	341	14	19.01	6.70
Class A	566	22	20.96	6.90
Class AA	806	32	21.00	7.23
Total	2524	100	19.63	6.73

The mean score gain between AA and D Classifications indicated in Table 9, is approximately .5 of a point higher than the gain in Hypothesis 1 between tenth and twelfth grade, indicating a similar gain of mean scores. Not only do students in Class AA schools form the largest population with the highest mean score, but they also show the highest amount of variability. Such variability is likely attributable to another factor or factors other than school classification, such as socio-economic conditions, availability of private teachers and availability of quality musical concerts.

Table 9a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--School Classification.

Source of Variation	d.f.	Mean Square	F	p. less than
Classification	4	1493.27	34.73	0.0005
Residual	2519	43.00		
Total	2523			

Table 9b.--Scheffé Post Hoc Method of Multiple Comparisons Mean Differences (x-y).

	Class A (y)	Class B (y)	Class C (y)	Class D (y)
Class AA (x)	.04	1.99*	3.45*	3.06*
Class A (x)		1.95*	3.41*	3.02*
Class B (x)			1.46	1.07
Class C (x)				-.39

*Denotes significance at < 0.005 level.

Results of the Scheffé Post Hoc comparison determine that there is significant difference between Class AA and B, between AA and C, between AA and D, between A and B, between A and C, between A and D; however, no significant difference exists between Class AA and A, between B and C, between B and D or between C and D. If Class AA and A are considered large classifications and B, C, and D as

small, then significance exists between large and small classifications, but not within. Thus, students in larger schools scored higher on the test than students from smaller schools. As school size diminished, mean achievement decreased. On the basis of the above information: Hypothesis 2 is rejected.

Hypothesis 3. There is no significant difference in the cognitive music achievement of students who participate in MSBOA Band and Orchestra Festivals and those who do not.

Table 10.--Summary Statistics of Variable--Festival Attendance.

Category	N	% of Population	Mean	S. D.
Festival Attendance	2460	97	19.72	6.74
Festival Non-attendance	76	03	17.28	5.96
Total	2536	100	19.64	6.73

Table 10a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Festival Attendance.

Source of Variation	d.f.	Mean Square	F	p. less than
Festival Attendance	1	438.46	9.72	0.002
Residual	2534	45.09		
Total	2535			

The effect of festival attendance upon the dependent variable, although statistically significant to < 0.002, carries less emphasis than the seven other variables utilized in this test, for the other seven hypotheses are proven at the significance level of < 0.0005. Since the sample of the non-attendance group is comparably smaller, additional population samples may produce somewhat different results. However, on the basis of the above data: Hypothesis 3 is rejected.

Hypothesis 4. There is no significant difference in the cognitive music achievement of those students whose groups rate first division in MSBOA District Band and Orchestra Festivals and those whose groups do not.

Table 11.--Summary Statistics of Variable--Division Rating.

Category	N	% of Population	Mean	S. D.
I Rating	742	31	22.31	7.17
II Rating	1396	57	18.81	6.29
III Rating	292	12	17.60	5.92
Total	2430	100	19.73	6.76

Information in Table 11 illustrates that while less than one-third of the bands and orchestras that attended district festivals received a first division rating, the scores of the students in these groups generated the greatest achievement plus the greatest variability.

Table 11a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--District Rating.

Source of Variation	d.f.	Mean Square	F	p. less than
District Rating	2	3715.22	87.19	0.0005
Residual	2427			
Total	2429			

Table 11b.--Scheffé Post Hoc Method of Multiple Comparisons Mean Differences (x-y).

	II Rating (y)	III Rating (y)
I Rating (x)	3.49*	4.71*
II Rating (x)		1.21

*Denotes significance at < 0.005 level.

The Scheffé Post Hoc comparison reveals in Table 11b that there is a significant difference between first division and second division, between first division and third division; but no significant difference between second and third division ratings. Therefore, on the basis of the above information: Hypothesis 4 is rejected.

Hypothesis 5. There is no significant difference in the cognitive music achievement of students who play instruments in the four separate families.

Table 12.--Summary Statistics of Variable--Instrument Family.

Category	N	% of Population	Mean	S. D.
Brass	855	34	19.61	6.72
Percussion	237	9	16.11	5.54
Woodwind	1248	50	19.97	6.43
String	162	7	24.07	7.25
Total	2502	100	19.74	6.69

The information in Table 12 illustrates the fact that students who play instruments in the four separate families scored differently on this test. While woodwind and brass players scored similarly, the percussion players scored perceptibly lower and the string players perceptibly higher. This table reveals the somewhat surprising fact that there are two per cent more percussionists than string players in this sample of Michigan high schools. Again, as in the past hypotheses, the highest mean score also contains the greatest variability.

Table 12a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Instrument Family.

Source of Variation	d.f.	Mean Square	F	p. less than
Instrument Family	3	2084.49	49.23	0.0005
Residual	2498	42.34		
Total	2501			

Table 12b.--Scheffé Post Hoc Method of Multiple Comparisons Mean Differences (x-y).

	Woodwind (y)	Brass (y)	Percussion (y)
String (x)	4.20*	4.46*	7.96*
Woodwind (x)		.36	3.88*
Brass (x)			3.50*

*Denotes significance at < 0.005 level.

The Scheffé Post Hoc comparison reveals in Table 12b that significant differences exist between string and woodwind, between string and brass, between string and percussion, between woodwind and percussion, between brass and percussion players but none exist between brass and woodwind players. The greatest meaningful difference exists between string and percussion players, for the string players scored approximately fifty per cent higher than the percussion players. This is the largest mean difference of score thus far on the test. If a one-way analysis of variance had been made using only the scores of string players and percussionists, the effect of instrument upon the dependent variable would have been more pronounced. Thus, on the basis of the above information: Hypothesis 5 is rejected.

Hypothesis 6. There is no significant difference in the cognitive music achievement of students who have taken private lessons and those who have not.

Table 13.--Summary Statistics of Variable--Private Lessons.

Category	N	% of Population	Mean	S. D.
Private Lessons	999	40	22.46	7.21
No Private Lessons	1500	60	17.90	5.66
Total	2499	100	19.72	6.71

Table 13a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Private Lessons.

Source of Variation	d.f.	Mean Square	F	p. less than
Private Lessons	1	12,458.43	311.36	0.0005
Residual	2497	40.01		
Total	2498			

A study of data in Tables 13 and 13a will reveal that private lessons do present a strong effect upon the dependent variable. Although there is considerably more variability in the private lessons group, the mean score is more than 4.5 points higher than the score of the non-private lessons group. There would appear to be strong meaningful difference between the two groups. On the basis of the above information: Hypothesis 6 is rejected.

Hypothesis 7. There is no significant difference in the cognitive music achievement of those students whose

parents, one or both, have participated in a school band or orchestra and those students whose parents have not.

Table 14.--Summary Statistics of Variable--Parent Participation.

Category	N	% of Population	Mean	S. D.
Parent Participation	892	36	20.78	7.03
No Parent Participation	1599	64	19.11	6.44
Total	2491	100	19.71	6.70

Table 14a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Parent Participation.

Source of Variation	d.f.	Mean Square	F	p. less than
Parent Participation	1	1597.26	36.08	0.0005
Residual	2489	44.27		
Total	2490			

The statistics from Tables 14 and 14a indicate significance at less than 0.0005; however, as in Hypothesis 3, the meaningful difference is less pronounced. There is a small variation of group means around the grand mean which would indicate less effect of the independent variable

upon the dependent variable. However, based upon the above information: Hypothesis 7 is rejected.

Hypothesis 8. There is no significant difference in the cognitive music achievement of those students who have taken a formal music theory course in high school or summer music camp and those who have not.

Table 15.--Summary Statistics of Variable--Music Theory Course.

Category	N	% of Population	Mean	S. D.
Theory Course	376	15	24.69	7.89
No Theory Course	2132	85	18.86	6.07
Total	2508	100	19.74	6.69

Table 15a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Music Theory Course.

Source of Variation	d.f.	Mean Square	F	p. less than
Theory Course	1	10,858.10	268.38	0.0005
Residual	2506	40.46		
Total	2507			

Statistics in Tables 15 and 15a indicate a strong effect of the independent variable upon the dependent variable. The mean of 24.69 is the largest mean score of

any grouping thus far on the test. Furthermore, the difference between the two groups is almost six points, which is likewise the largest thus far. Such a result is expected since the test is based primarily upon knowledge of music theory and its application. On the basis of the above information: Hypothesis 8 is rejected.

Hypothesis 9. There is no significant difference in the cognitive music achievement of those students who have taken instrumental music in the secondary school and those who have not.

Table 16.--Summary Statistics of Variable--Treatment.

Category	N	% of Population	Mean	S. D.
Treatment	2563	95	19.58	6.74
Control	141	05	12.82	3.57
Total	2704	100	19.22	6.78

Table 16a.--One-Way Analysis of Variance. Dependent Variable--Score of Test, Category Variable--Treatment.

Source of Variation	d.f.	Mean Square	F	p. less than
Treatment	1	6093.67	139.33	0.0005
Residual	2702	43.74		
Total	2703			

Statistically, Table 16a reveals a significance at < 0.0005 which would indicate a strong influence of the treatment group upon the score. However, in the light of a meaningful difference, one would expect the mean score difference between the two groups to be larger. This situation has been affected by the difficulty of the test and by the large number of relatively low scores, which is evident from the frequency distribution in Table 7. Stated in another manner, the scores of some Michigan band and orchestra students indicate considerable cognitive achievement while other scores are low. There is a large variability in achievement scores by Michigan band and orchestra students. On the basis of the statistical information provided in Tables 16 and 16a: Hypothesis 9 is rejected.

Table 16b.--Supplementary Information Relative to Hypothesis 9. Mean Differences.

Test Items	Control Group	Treatment Group	Difference
$\bar{X}$, 1-23	8.12	11.94	3.82
$\bar{X}$, 24-46	4.70	7.64	2.94
Total Mean	12.82	19.58	

The information in Table 16b indicates a corresponding gain by the treatment group in both aural perception and in visual cognitive knowledge over the control group. Since

the mean score for the first twenty-three items is higher in both groups than the last twenty-three items, some factor or factors are present to cause this difference. This investigator theorizes that, since all the items from one to twenty-three are aural, this factor is aptitude. It is worthy of note that by pure chance one would answer correctly 4.52 questions on the aural part of the test and 4.60 questions on the visual part. Thus, the achievement is 3.70 points above chance by the control group and 10.66 points above chance by the treatment group.

Interaction of Variables

It was decided to analyze the interaction of six of the above variables. The number of possible combinations of interactions utilizing the eight variables is staggering; therefore, those six which had the greatest effect upon the dependent variable were used in the study. Grade, school classification, district rating, instrument family, private lessons and music theory course were used in three interaction analyses.

There is a constant gain of mean scores, with three exceptions, in tenth, eleventh, and twelfth grade students, as reported in Table 17, within all classifications. The highest mean score of 22.86 by twelfth grade Class AA students and the lowest mean score of 17.12 by tenth grade Class D students reveals a mean difference of 5.74. The three mentioned exceptions involve eleventh and twelfth grade Class C and D where D students scored higher and

Table 17.--Summary Statistics, Grade--Classification Interaction.

	Tenth	Eleventh	Twelfth
AA (N)	369	246	173
Mean Score	19.65	22.03	22.86
A (N)	253	176	128
Mean Score	19.66	21.87	22.64
B (N)	155	105	63
Mean Score	18.24	19.20	21.92
C (N)	334	225	126
Mean Score	17.18	17.34	18.94
D (N)	59	34	30
Mean Score	17.12	17.76	19.80

Pooled within-cell standard deviation = 6.45

Class A and AA where Class A tenth graders scored .01 point higher than Class AA tenth grade students. It is interesting to note that the greatest mean gain from tenth to twelfth grade occurs in Class B with a gain of 3.68 while Class C is the lowest with a gain of 1.76.

Table 17a.--Two-Way Analysis of Variance with Fixed Effect Model. Interaction of Grade and Classification.

Source of Variation	d.f.	Mean Square	F	p. less than
Grade (G)	2	1006.62	24.21	0.0001*
Classification (C)	4	1439.48	34.62	0.0001*
(G) - (C) Interaction	8	66.21	1.59	0.1219
Residual	2461	41.58		
Total	2475			

*Denotes significance at < 0.005 level.

The information contained in Table 17a indicates significance of both grade and classification as a significant effect upon the dependent variable; however, this had been proven earlier. The interaction of the two variables produces a significance at the .12 level.

Table 18.--Summary Statistics, Private Lessons--Instrument Family Interaction.

Private Lessons	Brass	Percussion	Woodwind	String
Yes (N)	303	93	483	116
Mean Score	21.95	18.01	22.70	26.40
No (N)	544	136	756	45
Mean Score	18.33	15.03	18.22	18.33

Pooled within-cell standard deviation = 6.17

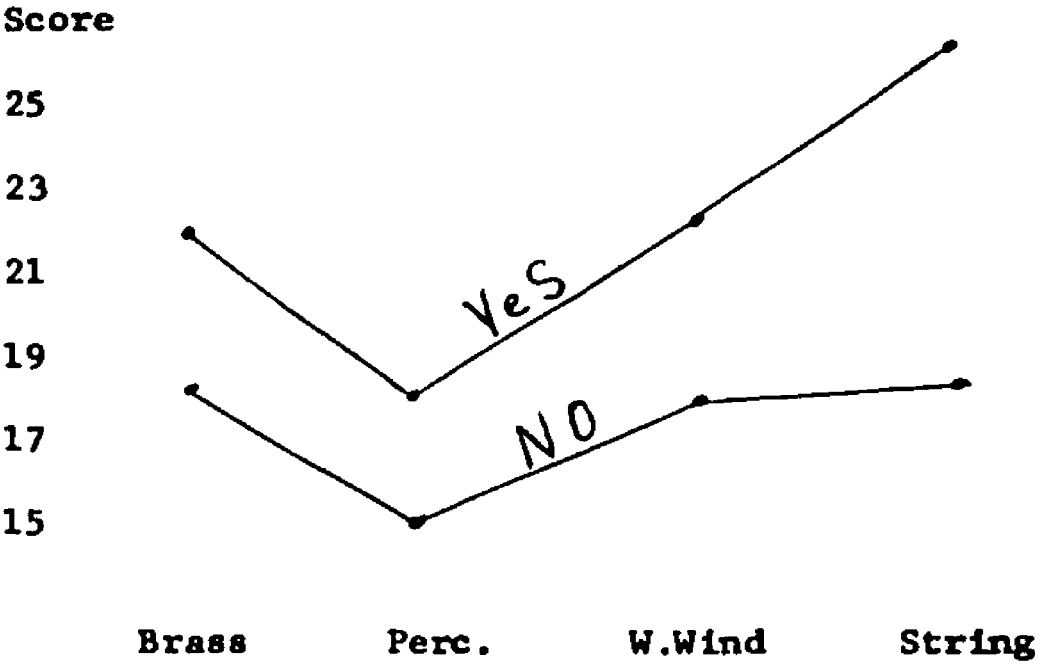
The data contained in the interaction of private lessons and instrument family provide some of the most revealing information of the entire study. From a study of Table 18 it is determined that there is a large meaningful difference between the scores of those percussion players who did not take private lessons and the string players who did. The percussion players mentioned scored only slightly less than six points above pure chance while the string players provided a mean score seventy-five per cent greater than the percussion players. It may also be noted from this table that those percussion players who took private lessons scored lower than students in all other instrument groups who did not. This fact becomes more marked when one recalls the strong effect of private lessons upon the dependent variable.

Table 18a.--Two-Way Analysis of Variance with Fixed Effect Model. Private Lessons--Instrument Family Interaction.

Source of Variation	d.f.	Mean Square	F	p. less than
Private Lessons (P)	1	6371.91	167.65	0.0000*
Instrument Family (I)	3	1216.43	32.00	0.0000*
(P)-(I) Interaction	3	217.37	5.72	0.0007*
Residual	2467	38.01		
Total	2474			

*Denotes significance at < 0.005 level.

Graph A.--Interaction of Private Lessons--Instrument Family.



By observing Graph A, one can see that the effect of private lessons on scores of brass, percussion and woodwind players is similar, in that the increase is approximately 3 to 4.5 points, whereas the addition of private lessons for the string players provides a difference of over 8 points. It should also be noted that the difference between string players who took private lessons and percussion players who did not is nearly 11.5 points.

A final interaction was made with district rating, music theory course and private lessons as independent variables. From the information in Table 19 one can determine that approximately a thirteen point spread exists from highest to lowest mean group scores. Third division students who had not taken private lessons or a music theory course scored a mean of 16.34, while first

Table 19.--Summary Statistics--District Rating, Private Lessons, Music Theory Course Interaction.

Independent Variables				Summary Statistics	
	District Rating	Private Lessons	Theory	N	Mean
1.	I	Yes	Yes	101	29.24
2.	I	Yes	No	292	22.96
3.	I	No	Yes	57	22.77
4.	I	No	No	282	19.50
5.	II	Yes	Yes	95	27.11
6.	II	Yes	No	398	20.02
7.	II	No	Yes	66	19.47
8.	II	No	No	799	17.36
9.	III	Yes	Yes	19	23.53
10.	III	Yes	No	51	19.75
11.	III	No	Yes	15	20.27
12.	III	No	No	201	16.34

Pooled within-cell standard deviation = 5.90

Table 19a.--Cell Means, Music Theory Course--Private Lessons.

	Theory - Yes	Theory - No
Private Lessons Yes	Cell #1,5,9 Mean 27.79	Cell #2,6,10 Mean 21.16
Private Lessons No	Cell #3,7,11 Mean 20.96	Cell #4,8,12 Mean 17.67

division students who had taken both scored a mean of 29.24. From observation of the same table it would appear that the combination of private lessons and a music theory course would, in fact, produce a strong interaction, for the score of the second division group with both private lessons and music theory course produces the second highest mean score and the third division group with both private lessons and music theory course produces the third highest score.

Table 19b.--Three-Way Analysis of Variance with Fixed Effect Model. District Rating--Private Lessons--Music Theory Course Interaction.

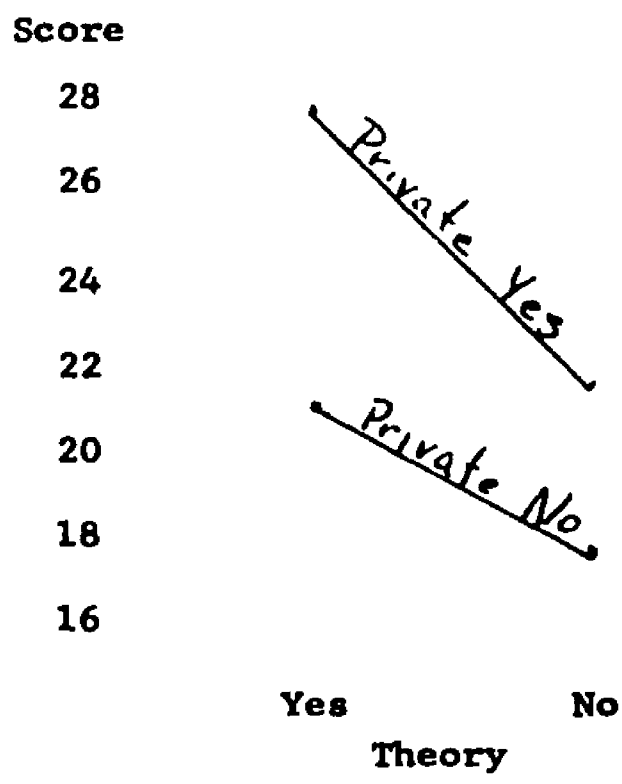
Source of Variation	d.f.	Mean Square	F	p. less than
District Rating (D)	2	1115.46	32.09	0.0001*
Private Lessons (P)	1	3476.61	100.01	0.0001*
Theory Course (T)	1	3370.13	96.95	0.0001*
(D)-(P) Interaction	2	38.38	1.10	0.33
(D)-(T) Interaction	2	9.50	0.27	0.76
(P)-(T) Interaction	1	296.45	8.53	0.004*
(D)-(P)-(T) Interaction	2	86.07	2.48	
Residual	2364	34.76		
Total	2375			

*Denotes significance at 0.005 level.

In Table 19b it can be seen that there is an interaction at the level of significance with private lessons

and music theory course. There is a weaker interaction of all three independent variables not at the significant level. There is little interaction between district rating and private lessons and practically none with district rating and music theory course.

Graph B.--Interaction of Private Lessons--Music Theory Course.



Graph B indicates the interaction of music theory course and private lessons without the effect of district rating.

Table 20 indicates that in this study knowing whether or not a student takes private lessons accounts for eleven per cent of the total variance of the dependent variable.

Table 20.--Comparison of the Influence of the Independent Variables Upon the Dependent Variable.

Source of Variation	Multiple Correlation Coefficient (R)	Coefficient of Determination (R^2)
Private Lessons	.33	11%
Music Theory Course	.31	10%
District Rating	.26	07%
Instrument Played	.24	06%
School Classification	.23	05%
Grade in School	.17	03%
Parent Participation	.12	01%
Festival Attendance	.06	00.1%

It should be noted that these percentages are not cumulative; therefore, one may not add them to determine a total percentage. This table indicates that relative to cognitive music achievement the effect of whether or not a student participates in a band and orchestra festival is less than the effect of the rating his group attains when they do participate.

Supplementary Findings

In addition to the previous findings other information was compiled on the basis of the results of the test. This information indicates the status as of May, 1972.

1. Enrollment in band or orchestra by grade:

    Tenth grade--1184 students (47%)

    Eleventh grade--799 students (32%)

    Twelfth grade--528 students (21%)

2. Enrollment in band or orchestra by class size:

    Class AA--806 students (32%)

    Class A--566 students (22%)

    Class B--341 students (14%)

    Class C--688 students (27%)

    Class D--123 students (05%)

3. Enrollment in band or orchestra by participation in district band and orchestra festivals:

    Festival attendance--2460 students (97%)

    Festival non-attendance--76 students (03%)

4. Enrollment in band or orchestra by division rating in district band and orchestra festivals:

    First division--742 students (31%)

    Second division--1396 students (57%)

    Third division--292 students (12%)

5. Enrollment in band and orchestra by instrument family:

    Brass--855 students (34%)

    Percussion--237 students (09%)

    Woodwind--1248 students (50%)

    String--162 students (07%)

6. Enrollment in band or orchestra by those who have taken ten or more private lessons in the past five years:

Private lessons--999 students (40%)

No private lessons--1500 students (60%)

7. Enrollment in band or orchestra by those who have at least one parent who participated in a school band or orchestra:

   Parent participation--892 students (36%)

   No parent participation--1599 students (64%)

8. Enrollment in band or orchestra by those who have taken a formal music theory course in high school or summer music camp:

   Music theory course--376 students (15%)

   No music theory course--2132 students (85%)

9. Enrollment in band or orchestra by instrument family and by private lessons:

   Brass--847 students, 303 took private lessons (36%)

   Percussion--229 students, 93 took private lessons (40%)

   Woodwind--1239 students, 483 took private lessons (39%)

   String--161 students, 116 took private lessons (72%)

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Introduction

This final chapter contains the concluding statements about the study. The first section is a summation of the development of the cognitive, aural-perception achievement test and its administration. The second section is a presentation of the conclusions drawn from the study while implications for further study are contained in the third and concluding section.

Summary

The purpose of this study was to assess the cognitive knowledge, verbal and aural, of a sample of the tenth, eleventh and twelfth grade instrumental music students in Michigan and to compare the sample and the results on the basis of eight variables. Since there was no test available which fit this specific purpose, the author developed a cognitive, aural-perception achievement test which could be administered in one normal class period. The test was developed from a list of objectives which band and orchestra directors in Michigan determined as logical outcomes from students' participation in bands and orchestras.

Three pilot tests were developed and administered in various locations in four Midwestern states. From these three pilots, the final statewide test was developed which consisted of twenty-three aural items, stimuli provided by a pre-recorded tape, and twenty-three visual items. The entire test required forty-two minutes for administration.

Instrumental music students from fifty-one randomly selected schools in Michigan took the test in May, 1972. The population tested included a control group of 141 students who had had no secondary instrumental music experience and the treatment group of 2563 students. The results of this test were analyzed by computer at Michigan State University and were presented in the preceding chapter.

Conclusions

On the basis of the data in Chapter IV and the rejection of all nine hypotheses the following conclusions may be stated:

1. The test was sensitive in uncovering the differentiates in cognitive music achievement among tenth, eleventh and twelfth grade students. The results suggest a linear relationship since the mean score of the eleventh graders was higher than that of the tenth graders and the mean score of the twelfth graders was higher than that of the eleventh graders. The differences were

too large to be attributed to chance; therefore, one is forced to conclude that achievement differs across grade levels.

2. The test was sensitive in uncovering the differentiates in cognitive music achievement among the various MSBOA school classifications. The mean score of students in larger schools was higher than the mean score of those in smaller schools. Although there was little meaningful difference between Class AA and Class A students and the mean score of Class D students was higher than the mean score of Class C students, the differences, in all classes, were too large to be attributed to chance; therefore, one is forced to conclude that achievement differs across school size.
3. The test was sensitive in uncovering the differentiates in cognitive music achievement between students who participated in MSBOA District Band and Orchestra Festivals and those who did not. The mean score of the students who participated was higher. This difference was too large to be attributed to chance; therefore, one is forced to conclude that achievement differs from festival participation to non-participation.
4. The test was sensitive in uncovering the differentiates in cognitive music achievement among students whose groups received various ratings in MSBOA

District Band and Orchestra Festivals. The results suggest a linear relationship since the mean score of the students in second division groups was higher than the mean score of those in third division groups and the mean score of the students in first division groups was higher than the mean score of those in second division groups. The differences were too large to be attributed to chance; therefore, one is forced to conclude that achievement differs across district band and orchestra ratings.

5. The test was sensitive in uncovering the differentiates in cognitive music achievement among the players of instruments in the four families of instruments. The mean score of the string players was highest of the four groups, while the mean score of the percussion players was the lowest. These differences were too large to be attributed to chance; therefore, one is forced to conclude that achievement differs across the various instrument families.
6. The test was sensitive in uncovering differentiates in cognitive music achievement between students who took private lessons and those who did not. The mean score of those students who took private lessons was higher. This difference was too large to be attributed to chance; therefore,

one is forced to conclude that achievement differs from taking private lessons to not taking private lessons.

7. The test was sensitive in uncovering differentiates in cognitive music achievement between students whose parents participated in band or orchestra and those whose parents did not. The mean score of the students whose parents participated was higher. The difference was too large to be attributed to chance; therefore, one is forced to conclude that achievement differs from parental participation to non-participation.
8. The test was sensitive in uncovering the differentiates in cognitive music achievement between students who had taken a formal music theory course and those who had not. The mean score of those who had taken a music theory course was higher. The difference was too large to be attributed to chance; therefore, one is forced to conclude that achievement differs from election to non-election of a music theory course.
9. The test was sensitive in uncovering the differentiates in cognitive music achievement between students who participated in a school band or orchestra and those who did not. The mean score of those who participated was higher. The difference was too large to be attributed to

chance; therefore, one is forced to conclude that achievement differs from those who participate to those who do not.

Several interactions were derived from the two and three-way analyses. In general, on the basis of mean scores, older students from larger schools scored higher than younger students in smaller schools. A strong interaction existed when string players took private lessons inasmuch as their scores were much higher than those of any other instrumentalists. A strong interaction was also present for students with private lessons and music theory course inasmuch as their scores were likewise much higher.

In addition to the above conclusions, the test provided further information.

There was a considerable variance in the achievement of students in different schools (see Appendix H). The highest mean score of 24.88 was nearly twice as large as the lowest, 13.73. Furthermore, the mean score of the lowest school in the treatment group was less than one point higher than the mean score of the total control group who had had no secondary school band or orchestra experience. The musical cognitive knowledge gain in some schools was minimal.

It is very evident that students who achieved higher scores also listened more carefully to instructions and filled out responses on answer sheets more completely.

Through a sorting of the computer cards it was observed that students in the upper ten per cent rarely omitted information while such omissions were commonplace on the cards of the lower ten per cent.

It should be noted that although there was statistical significance for all variables, grade in school, parent participation and festival participation provided the least meaningful differences. Furthermore, it would seem there should have been a larger mean difference in score between the treatment and the control groups. It seems likely that experience in a high school band or orchestra should have provided higher scores on this test.

The greatest meaningful difference was provided by private lessons. The music theory course provided a strong meaningful difference but this was to be expected. While not so conclusive as these two variables, district rating, instrument family and school classification did provide a strong meaningful difference.

There is a need for a larger number of music achievement tests which are both valid and reliable. Many existing tests are designed for a specific purpose; hence are not good measures for other than that one purpose. The Roth Cognitive, Aural-Perception Test is both a valid and a reliable instrument to measure cognitive musical achievement, especially when measuring groups of students. Although it is a multi-factor test it has functioned well as a measuring instrument.

On the basis of work done in this study it seems that it is possible to develop an even more reliable multi-factor cognitive music achievement test which does not require more than fifty minutes for administration. A battery of tests is time-consuming, for it requires either several days of single-period administration or one day of multiple-period administration. In either case, the effect of testing may produce fatigue, boredom or disinterest among the students. It is likely that the students would not perform to their capabilities under such conditions. A multiple-period test is disruptive to the normal school program. In addition, mortality caused by student absences may result in a greater loss of testable population in the administration of a multiple-period test. Therefore, a test which is both reliable and valid and requires but one normal school period for administration would be superior to those which require multiple periods. It is the opinion of this investigator that, on the basis of the results obtained in this study, it is possible to develop such a test.

Implications for Further Research

As a result of the findings of this study, a number of implications for further research are clear. The fact that forty-seven per cent of the instrumental music students in Michigan are in the tenth grade while only twenty-one per cent are twelfth graders indicates a possible dropout problem. It would be in error to state that there is

greater than a 100% dropout, for such a statement would require a three-year study. There is, however, clear evidence that the participation becomes less in the eleventh grade and still less in the twelfth grade. It would be of great value in the evaluation and planning of instrumental music programs to determine the reasons for this lessening participation. Such a study, if statewide in nature, could have great impact in curriculum reorganization.

It was previously stated that a great variance of achievement existed between schools. This, too, indicates the need for further study. What are the factors that cause this variance? Do situations exist which could be changed to increase achievement? Do similar factors appear in other schools which might indicate a widespread deficiency?

The large variance in the achievement of students who play different instruments indicates a need for study. Are the string players, who scored high, achieving because of the musical demands of their instruments or have they been placed upon the instruments by teachers whose selection process places high achievers in the string family? Are teachers more efficient in their teaching of string players than they are in teaching percussionists? Does the college preparation of these teachers encourage this problem by placing greater emphasis upon the string family with little

emphasis on percussion? Why do percussionists score so very low? The answers to the above questions can be provided by further research.

It is possible, in the opinion of the investigator, to develop a test which will measure the construct of cognitive music achievement. However, it must be determined what factors make up this construct. It seems obvious that there are many factors at work, with varying degrees of effect, in determining individual student achievement. Likewise, it seems obvious that individual students react differently to the effects of such factors. If it were possible to determine the factors which do influence musical achievement, the profession would be in a much better position to reorganize its existing music curricula into more productive programs. Although such answers may be either elusive or difficult to analyze and put into practice, the music education profession should continually strive for such solutions.

BIBLIOGRAPHY

Books

Barr, Arvil S.; Davis, Roberta A.; and Johnson, Palmer O. Educational Research and Appraisal. Chicago: J. B. Lippincott Company, 1953.

Bloom, Benjamin S. Taxonomy of Educational Objectives. New York: David McKay Company, Inc., 1956.

Borg, Walter R. Educational Research, An Introduction. New York: David McKay Company, Inc., 1963.

Brown, Frederick G. Measurement and Evaluation. Itasca, Illinois: F. E. Peacock, 1971.

Chauncey, Henry, and Dobbin, John E. Testing, Its Place in Education Today. New York: Harper and Row, 1963.

Colwell, Richard. The Evaluation of Music Teaching and Learning. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1970.

Cronbach, Lee J. Essentials of Psychological Testing. New York: Harper & Brothers, 1949.

Ebel, Robert L. Essentials of Educational Measurement. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1972.

Gronlund, Norman E. Constructing Achievement Tests. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968.

_____. Measurement and Evaluation in Teaching. New York: The Macmillan Company, 1971.

Lehman, Paul R. Tests and Measurements in Music. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968.

Leonhard, Charles, and House, Robert W. Foundations and Principles of Music Education. New York: McGraw-Hill Book Co., 1959.

Mager, R. F. Developing Attitude Toward Learning. Palo Alto, Calif.: Fearon, 1968.

_____. Preparing Instructional Objectives. Palo Alto, Calif.: Fearon, 1962.

Michigan School Band and Orchestra Association. Handbook of Music Theory. Ann Arbor: Michigan School Band and Orchestra Association, 1964.

_____. Music History and Literature, a Handbook for Rehearsal Enrichment. Ann Arbor: Michigan School Band and Orchestra Association, 1970.

Nunnally, Jum C. Psychometric Theory. New York: McGraw-Hill, 1967.

Remmers, H. H., and Gage, N. L. Educational Measurement and Evaluation. New York: Harper & Brothers, 1943.

Tate, Merle W. Statistics in Education and Psychology. New York: The Macmillan Company, 1965.

Thorndike, Edward L. An Introduction to the Theory of Mental and Social Measurements. 2nd ed. New York: Teachers College, Columbia University, 1913.

Thorndike, Robert L., and Hagen, Elizabeth. Measurement and Evaluation in Psychology and Education. New York: John Wiley and Sons, 1961.

Van Dalen, Deobold B., and Meyer, William J. Understanding Educational Research. New York: McGraw-Hill, 1962.

Whybrew, William E. Measurement and Evaluation in Music. Dubuque, Iowa: Wm. C. Brown Company, 1962.

Standardized Tests

Aliferis, James. Aliferis Music Achievement Test. Minneapolis: University of Minnesota Press, 1954.

Colwell, Richard. Music Achievement Tests. Chicago: Follett Publishing Company, 1965.

Knuth, Alice Snyder. Snyder Knuth Music Achievement Test. San Francisco: Creative Arts Research Associates, 1965.

Watkins, John G., and Farnum, Stanley E. Watkins-Farnum Performance Scale. Winona, Minn.: Hal Leonard Music, Inc., 1954.

Dissertations

Folstrom, Roger J. "A Comparison Study of the Musical Achievement of Students in Three Illinois High Schools." Unpublished Ph.D. dissertation, Northwestern University, 1967.

Iltis, John L. "The Construction and Validation of a Test to Measure the Ability of High School Students to Evaluate Musical Performance." Unpublished Mus. Ed.D. dissertation, Indiana University, 1970.

Mansur, Paul M. "An Objective Performance-Related Music Achievement Test." Unpublished Ph.D. dissertation, University of Oklahoma, 1965.

Snyder, Alice M. "The Development and Standardization of a Test of Music Achievement." Unpublished Ph.D. dissertation, University of Oregon, 1958.

Swinchoski, Albert A. "The Development of a Standardized Music Achievement Test for the Intermediate Grades." Unpublished Ph.D. dissertation, University of Kansas, 1963.

Articles in Journals

Aliferis, James, and Stechlein, James E. "The Development of a College Entrance Test in Music Achievement." Journal of Research in Music Education, No. 2 (1953), 83-96.

Colwell, Richard. "An Investigation of Musical Achievement Among Vocal Students, Vocal-Instrumental Students and Instrumental Students." Journal of Research in Music Education, No. 11 (Fall, 1963), 123-130.

_____. "The Development of the Music Achievement Test Series." Council for Research in Music Education, No. 22 (Fall, 1970), 57-73.

Ebel, Robert L. "Some Measurement Problems in a National Assessment of Educational Progress." Journal of Educational Measurement, Volume 3, No. 1 (Spring, (1966), 11-17.

Holz, Emil A. "The National School Band Tournament of 1923 and its Bands." Journal of Band Research, III (Autumn, 1966), 17.

Merwin, Jack C. "The Progress of Exploration Toward a National Assessment of Educational Progress." Journal of Educational Measurement, Vol. 3, No. 1 (Spring, 1966), 5-10.

Tyler, Ralph W. "The Objectives and Plans for a National Assessment of Educational Progress." Journal of Educational Measurement, Volume 3, No. 1 (Spring, 1966), 1-4.

Woodruff, Asahel D. "Concept Teaching in Music." Perspectives in Music Education Source Book III, Edited by Bonnie C. Kowall. Washington, D. C.: MENC, 1966, 219-223.

Miscellaneous

Buros, Oscar Krisen. Mental Measurements Yearbook. Highland Park, N. J.: The Gryphon Press, 1972.

Merwin, J. C., and Womer, F. B. "Evaluation in Assessing the Progress of Education to Provide Bases of Public Understanding and Public Policy." Educational Evaluation: New Roles, New Means. Sixty-eighth Yearbook of the National Society for the Study of Education, Part II. Chicago: The University of Chicago Press, 1969.

Michigan State Board of Education. A Position Statement on Educational Accountability. Lansing, Mich.: Michigan State Board of Education, 1972.

Hightower, Caroline. How Much Are Students Learning? Report from the Committee on Assessing the Progress of Education. Ann Arbor, Mich.: November, 1968.

APPENDICES

APPENDIX A

TEST OBJECTIVES

APPENDIX A

TEST OBJECTIVES

Rehearsal Objectives

Please respond as to the importance of each objective--
1 is the lowest response while 11 is the highest response.

On the basis of participation in band or orchestra, Michigan high school instrumental music students should be able to:

1 2 3 4 5 6 7 8 9 10 11 (1) recognize major key signatures.

1 2 3 4 5 6 7 8 9 10 11 (2) recognize minor key signatures.

1 2 3 4 5 6 7 8 9 10 11 (3) recognize major and perfect intervals.

1 2 3 4 5 6 7 8 9 10 11 (4) recognize minor intervals.

1 2 3 4 5 6 7 8 9 10 11 (5) recognize augmented intervals.

1 2 3 4 5 6 7 8 9 10 11 (6) recognize diminished intervals.

1 2 3 4 5 6 7 8 9 10 11 (7) hear the difference between major, minor, and perfect intervals.

1 2 3 4 5 6 7 8 9 10 11 (8) place given composers in the correct period of music history.

1 2 3 4 5 6 7 8 9 10 11 (9) interpret basic musical terminology.

1 2 3 4 5 6 7 8 9 10 11 (10) detect incorrect phrasing.

1 2 3 4 5 6 7 8 9 10 11 (11) recognize different forms of the minor scale.

1 2 3 4 5 6 7 8 9 10 11 (12) spell basic triads in a given key.

1 2 3 4 5 6 7 8 9 10 11 (13) place the periods of music in chronological order.

1 2 3 4 5 6 7 8 9 10 11 (14) recognize the basic style of the major periods of music.

1 2 3 4 5 6 7 8 9 10 11 (15) hear intonation discrepancies in chords.

1 2 3 4 5 6 7 8 9 10 11 (16)	hear balance problems in chords.
1 2 3 4 5 6 7 8 9 10 11 (17)	hear rhythmic discrepancies from printed parts.
1 2 3 4 5 6 7 8 9 10 11 (18)	hear major and perfect intervals.
1 2 3 4 5 6 7 8 9 10 11 (19)	hear minor intervals.
1 2 3 4 5 6 7 8 9 10 11 (20)	hear augmented intervals.
1 2 3 4 5 6 7 8 9 10 11 (21)	hear diminished intervals.
1 2 3 4 5 6 7 8 9 10 11 (22)	recognize modal scales.
1 2 3 4 5 6 7 8 9 10 11 (23)	hear modal scales.
1 2 3 4 5 6 7 8 9 10 11 (24)	hear modulations.
1 2 3 4 5 6 7 8 9 10 11 (25)	recognize the basic forms in music (three part, two part, etc.).
1 2 3 4 5 6 7 8 9 10 11 (26)	transpose.
1 2 3 4 5 6 7 8 9 10 11 (27)	recognize contrapuntal writing versus homophonic writing.
1 2 3 4 5 6 7 8 9 10 11 (28)	recognize the difference between half steps and whole steps.
1 2 3 4 5 6 7 8 9 10 11 (29)	recognize the musical characteristics of the major periods of music.
1 2 3 4 5 6 7 8 9 10 11 (30)	recognize pentatonic and whole tone scales.
1 2 3 4 5 6 7 8 9 10 11 (31)	know the difference between parallel and relative minor.
1 2 3 4 5 6 7 8 9 10 11 (32)	recognize instruments by their characteristic sound.
1 2 3 4 5 6 7 8 9 10 11 (33)	recognize similar and dissimilar melodies.
1 2 3 4 5 6 7 8 9 10 11 (34)	recognize cadence points.
1 2 3 4 5 6 7 8 9 10 11 (35)	hear intonation discrepancies in a melodic line.
1 2 3 4 5 6 7 8 9 10 11 (36)	hear intonation discrepancies between individuals.

1 2 3 4 5 6 7 8 9 10 11 (37)	hear the difference between half steps and whole steps.
1 2 3 4 5 6 7 8 9 10 11 (38)	recognize meter upon hearing a melody.
1 2 3 4 5 6 7 8 9 10 11 (39)	hear a number and place it in the correct historical period.
1 2 3 4 5 6 7 8 9 10 11 (40)	interpret basic musical ornamentation.

Please add other objectives you feel to be important outcomes of high school instruction in band and orchestra.

APPENDIX B

PILOT TEST NO. 1, FREQUENCY DISTRIBUTION, ITEM DIFFICULTY AND DISCRIMINATION INDICES

APPENDIX B

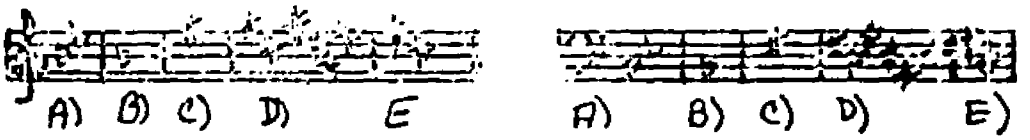
PILOT TEST NO. 1

Name _____

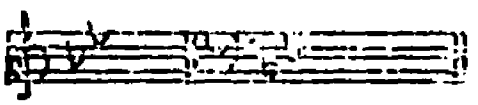
1. The key signature of A Major contains:

   A) 4 flats
   B) 1 sharp
   C) 4 sharps
   D) 3 sharps
   E) 2 flats

2. The key signature of F Major contains:

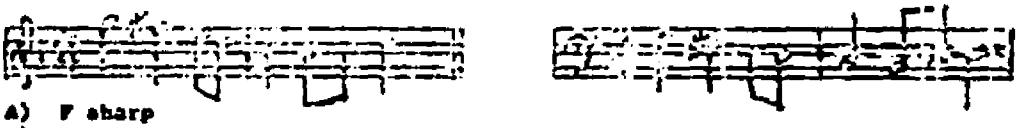


3. The following major key signature is:



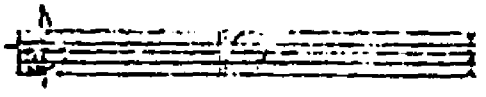
   A) E-flat
   B) A-Flat
   C) F
   D) B-Flat
   E) None of the above

4. The following melody is in the major key of:



   A) F sharp
   B) G
   C) D
   D) A
   E) None of the above

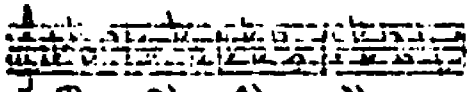
5. Name the following minor key signature



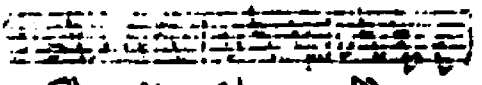
   A) E
   B) G
   C) C
   D) A
   E) None of the above

2.

6. The key signature of B-flat major is as follows:

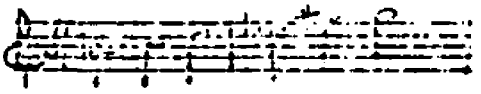


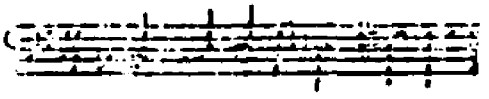
A) B) C) D)



A) B) C) D)

7. The following melody is in the key of:



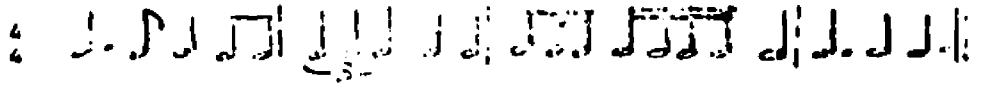


A) B-flat
B) C
C) E-flat
D) G
E) None of the above

8. The key signature of A minor contains:

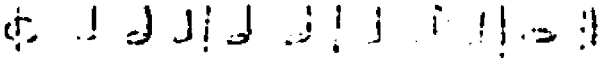
A) 1 sharp
B) 4 sharps
C) 3 sharps
D) 2 sharps
E) no sharps or flats

9. Which of the following measures is incorrect?



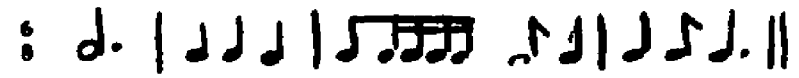
A) Measure 1
B) Measure 2
C) Measure 3
D) Measure 4
E) All are correct

10. Which of the following measures is incorrect?



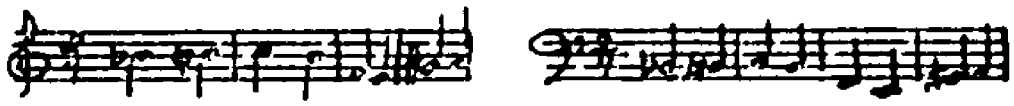
A) Measure 1
B) Measure 2
C) Measure 3
D) Measure 4
E) All are correct

11. Which of the following measures is incorrect?



A) Measure 1
B) Measure 2
C) Measure 3
D) Measure 4
E) All are correct

12. Which measures contain half steps?



A) Measure 1
B) Measure 2
C) Measure 3
D) Measure 4
E) All are correct

13. Which measures contain whole steps?

A) Measure 1
B) Measure 2
C) Measure 3
D) Measure 4
E) None contain whole steps

14. The five major periods of music chronologically from A.D. 1450 to present time are:

A) Classical, Baroque, Renaissance, Romantic, 20th Century
B) Renaissance, Classical, Baroque, Romantic, 20th Century
C) Renaissance, Baroque, Classical, Romantic, 20th Century
D) Renaissance, Baroque, Romantic, Classical, 20th Century
E) Renaissance, Romantic, Baroque, Classical, 20th Century

15. John Philip Sousa lived at the same approximate time and wrote in the same style as:

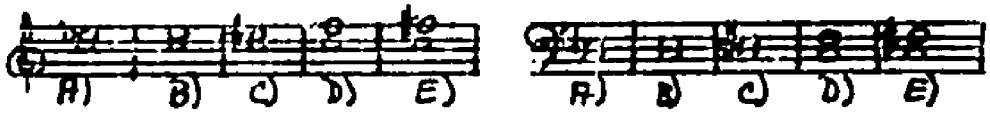
A) Bach
B) Beethoven
C) Mozart
D) None of the above
E) All of the above

--4--

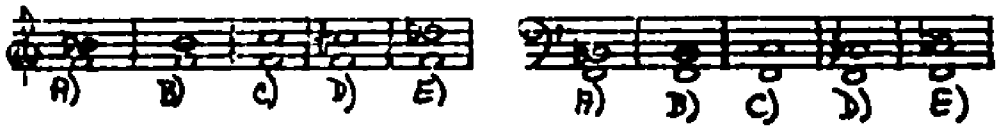
16. Which of the following composers would you more likely associate with a fugue?

A) Mozart
B) Beethoven
C) Bach
D) Bernstein
E) None of the above

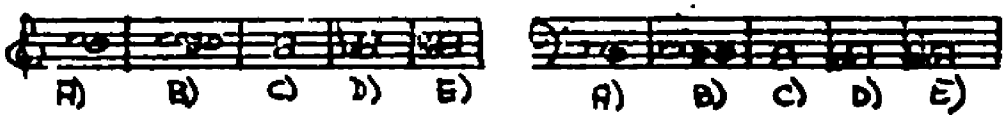
17. Which note is a major third above C?



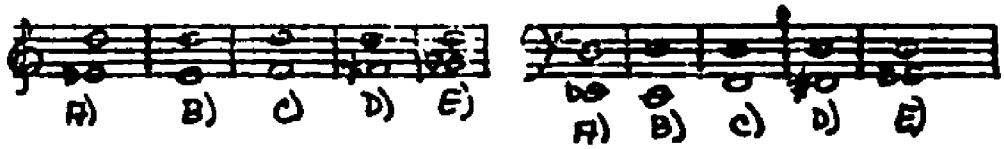
18. Which note is a perfect fourth above F ?



19. Which note is a major second below C?



20. Which note is a major sixth below D?



21. B double-flat (bb) sounds the same as:

A) A-flat
B) B
C) A
D) None of the above

22. Select the terms which most correctly describe " l'istesso tempo e espressivo."

A) At a slower tempo and expressive
B) At a faster tempo and expressive
C) At the same tempo and expressive
D) At the same tempo and no expression

23. Select the terms which most correctly describe " poco a poco ritard e sprcndo."

A) Much more slower and dying out
B) Slow down little by little and dying out
C) Slow down little by little and becoming louder
D) Speed up little by little and becoming louder

24. Select the terms which most correctly describe "allegro, pui pesante."

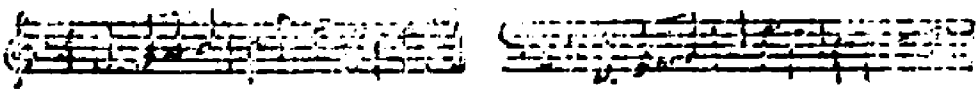
A) Moderately fast with heaviness
B) Very fast with heaviness
C) Moderately fast without passion
D) Very fast without passion

******** STOP ********

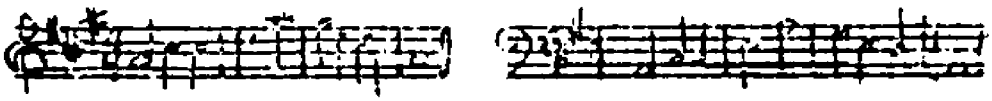
25. A) The bottom pitch was flat.
B) The middle pitch was flat.
C) The top pitch was flat.
D) The bottom pitch was sharp.
E) The top pitch was sharp.

26. A) The bottom pitch was flat.
B) The middle pitch was flat.
C) The top pitch was flat.
D) The bottom pitch was sharp.
E) The top pitch was sharp.

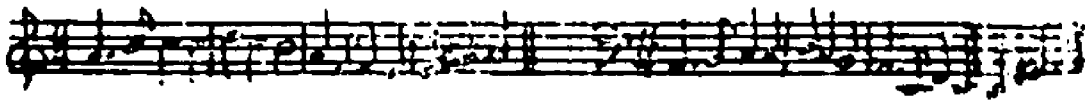
27. A) The bottom pitch was flat.
B) The middle pitch was flat.
C) The top pitch was flat.
D) The bottom pitch was sharp.
E) The top pitch was sharp.

28. 

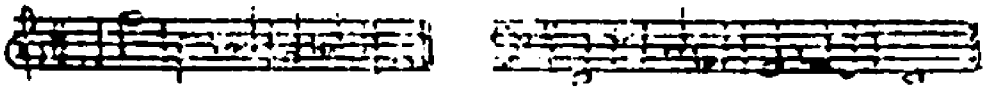
A). An intonation error occurs in measure #1.
B) An intonation error occurs in measure #2.
C) An intonation error occurs in measure #3.
D) An intonation error occurs in measure #4.
E) All measures are correct.

29. 

A). An intonation error occurs in measure #1.
B) An intonation error occurs in measure #2.
C) An intonation error occurs in measure #3.
D) An intonation error occurs in measure #4.
E) All measures are correct.

30. 

A) The flute was flat.
B) The flute was sharp.
C) The trumpet was flat.
D) The trumpet was sharp.

31. 

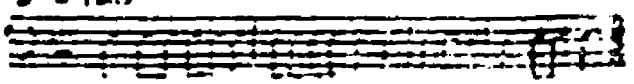
A) The clarinet was flat.
B) The clarinet was sharp.
C) The trombone was flat.
D) The trombone was sharp.

32. A) The bottom tones was too loud.
B) The middle tone was too loud.
C) The top tone was too loud.
D) All three tones were in proper balance.

33. A) The bottom tone was too short.
B) The middle tone was too loud.
C) The top tone was too loud.
D) All three tones were in proper balance.

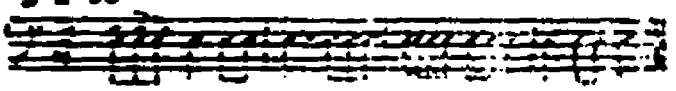
34. A) The bottom tone was too loud.
B) The middle tone was too loud.
C) The top tone was too loud.
D) All three tones were in proper balance.

35. ♩ = 120



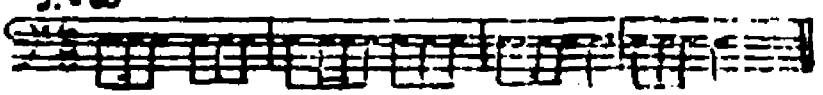
A) An error occurred in measure #1.
B) An error occurred in measure #2.
C) An error occurred in measure #3.
D) An error occurred in measure #4.
E) All measures were correct.

36. ♩ = 80



A) An error occurred in measure #1.
B) An error occurred in measure #2.
C) An error occurred in measure #3.
D) An error occurred in measure #4.
E) All measures were correct.

37. ♩. = 60



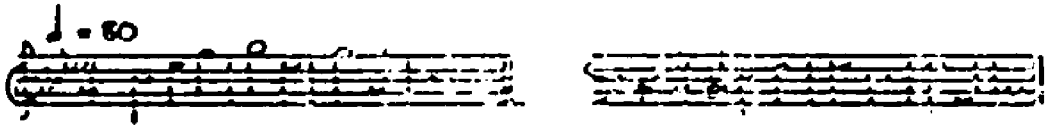
A) An error occurred in measure #1.
B) An error occurred in measure #2.
C) An error occurred in measure #3.
D) An error occurred in measure #4.
E) All measures were correct.

38. A) Pair #1 was a half-step.
B) Pair #2 was a half-step.
C) Pair #3 was a half-step.
D) Pair #4 was a half-step.

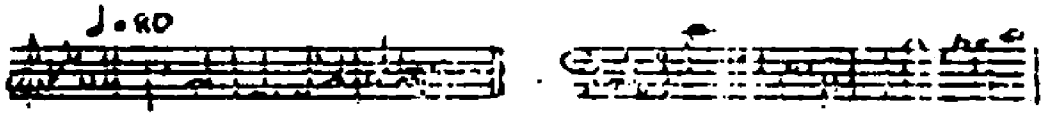
39. A) Pair #1 was a half-step.
B) Pair #2 was a half-step.
C) Pair #3 was a half-step.
D) Pair #4 was a half-step.

40. A) The second melody is the same as the first.
B) The second melody is different from the first.

41. A) The second melody is the same as the first.
B) The second melody is different from the first.

42. 

A) The error occurred in measure #1.
B) The error occurred in measure #2.
C) The error occurred in measure #3.
D) The error occurred in measure #4.

43. 

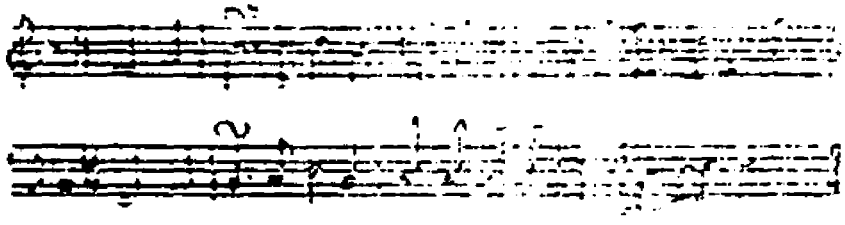
A) The error occurred in measure #1.
B) The error occurred in measure #2.
C) The error occurred in measure #3.
D) The error occurred in measure #4.

44. A) Excerpt #1.
B) Excerpt #2.
C) Excerpt #3.

45. A) Excerpt #1.
B) Excerpt #2.
C) Excerpt #3.

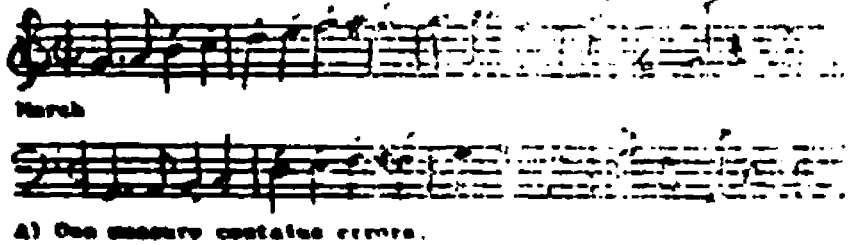
46. A) Excerpt #1.
B) Excerpt #2.
C) Excerpt #3.

47.



A) One measure contains errors.
B) Two measures contain errors.
C) Three measures contain errors.
D) Four measures contain errors.

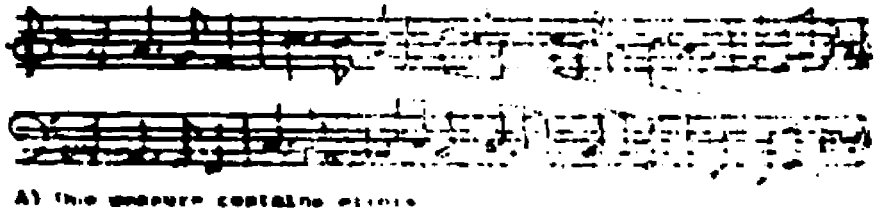
48. March



March

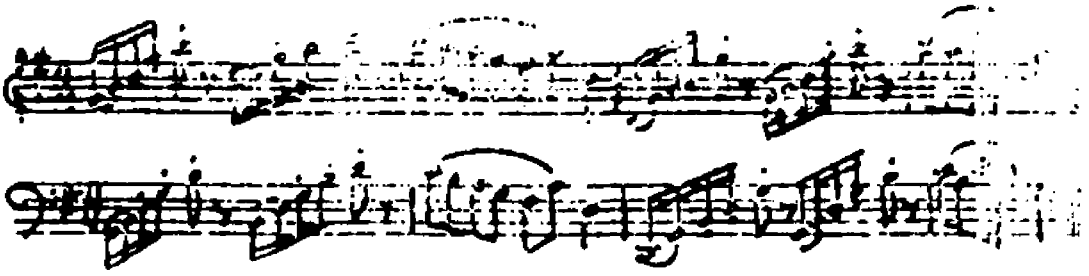
A) One measure contains errors.
B) Two measures contain errors
C) Three measures contain errors
D) Four measures contain errors

49.



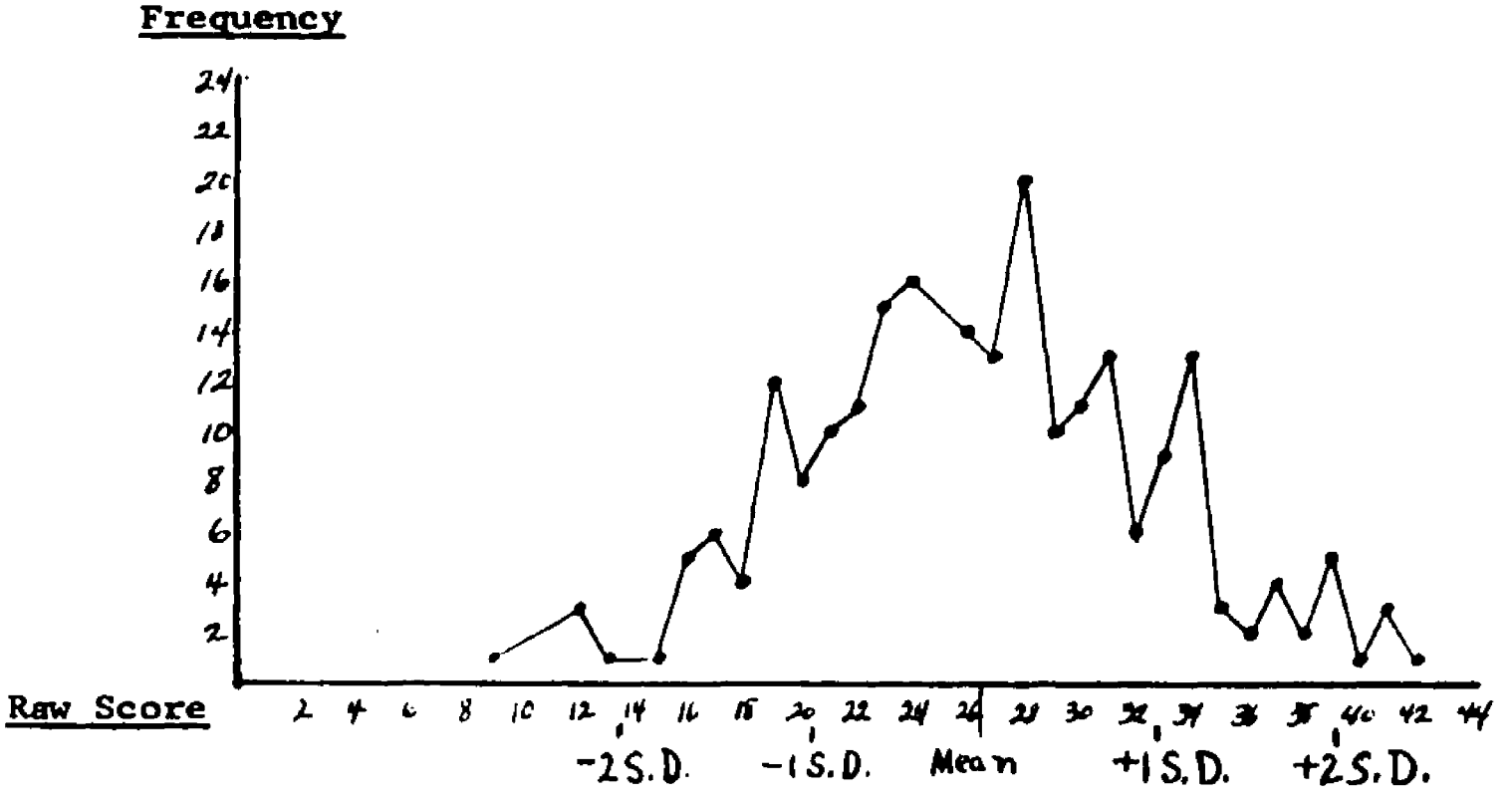
A) One measure contains errors
B) Two measures contain errors
C) Three measures contain errors.
D) Four measures contain errors

-10-

10. 

A) One measure contains errors.
B) Two measures contain errors.
C) Three measures contain errors.
D) Four measures contain errors.

FREQUENCY DISTRIBUTION--PILOT NO. 1



N = 230
Mean = 26.52
Median = 25.5
Mode = 28
S. D. = 6.34

ITEM DIFFICULTY AND DISCRIMINATION INDICES
PILOT TEST NO. 1

Item	Item Difficulty	Item Discrimination
1	41	56
2	23	39
3	23	41
4	41	49
5	61	64
6	65	44
7	70	42
8	49	59
9	68	35
10	29	46
11	42	45
12	27	50
13	44	64
14	62	47
15	20	36
16	51	50
17	34	59
18	74	39
19	67	37
20	64	25
21	21	41
22	73	15
23	27	31
24	66	35
25	57	24
26	76	19
27	68	31
28	79	6
29	71	7
30	72	19
31	73	10

(Continued)

Item	Item Difficulty	Item Discrimination
32	43	33
33	20	30
34	26	20
35	11	22
36	40	47
37	27	42
38	17	34
39	64	27
40	3	1
41	3	6
42	87	9
43	40	29
44	46	31
45	10	16
46	23	- 6
47	42	44
48	56	11
49	72	- 7
50	80	6

APPENDIX C

PILOT TEST NO. 2, FREQUENCY DISTRIBUTION, ITEM DIFFICULTY AND DISCRIMINATION INDICES

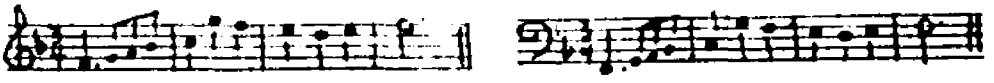
APPENDIX C

PILOT TEST NO. 2

PART I. Aural

1. 1) The bottom pitch was flat.
   2) The middle pitch was flat.
   3) The top pitch was flat.
   4) The bottom pitch was sharp.
   5) The top pitch was sharp.

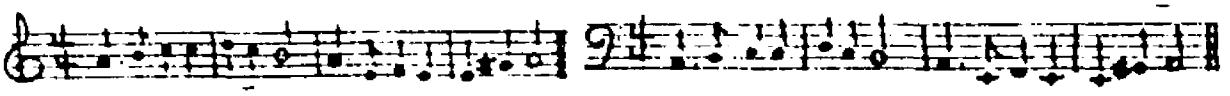
2. 1) The bottom pitch was flat.
   2) The middle pitch was flat.
   3) The top pitch was flat.
   4) The bottom pitch was sharp.
   5) The top pitch was sharp.

3. 

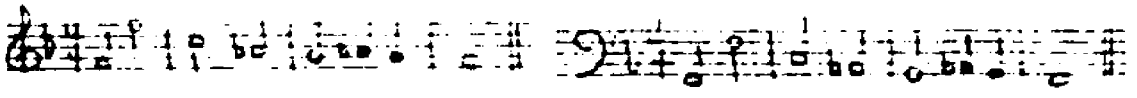
   1) An intonation error occurs in measure #1.
   2) An intonation error occurs in measure #2.
   3) An intonation error occurs in measure #3.
   4) An intonation error occurs in measure #4.
   5) All measures are correct.

4. 

   1) An intonation error occurs in measure #1.
   2) An intonation error occurs in measure #2.
   3) An intonation error occurs in measure #3.
   4) An intonation error occurs in measure #4.
   5) All measures are correct.

5. 

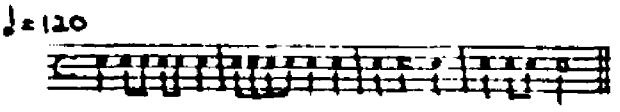
   1) The flute was flat.
   2) The flute was sharp.
   3) The trumpet was flat.
   4) The trumpet was sharp.
   5) The clarinet was flat.

6. 

1) The clarinet was flat.
2) The clarinet was sharp.
3) The trombone was flat.
4) The trombone was sharp.
5) The oboe was flat.

7. 1) The bottom tone was too loud.
2) The middle tone was too loud.
3) The top tone was too loud.
4) All three tones were in proper balance.

8. 1) The bottom tone was too loud.
2) The middle tone was too loud.
3) The top tone was too loud.
4) All three tones were in proper balance.

9. 

1) An error occurred in measure #1.
2) An error occurred in measure #2.
3) An error occurred in measure #3.
4) All measures were correct.

10. 

1) An error occurred in measure #1.
2) An error occurred in measure #2.
3) An error occurred in measure #3.
4) An error occurred in measure #4.
5) All measures were correct.

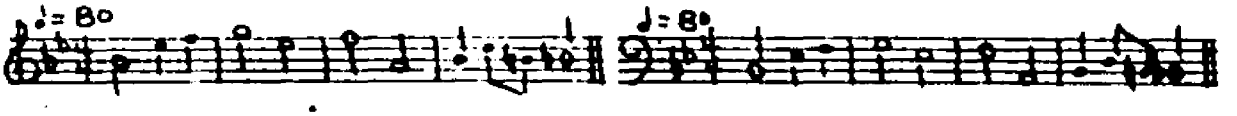
11. 

1) An error occurred in measure #1.
2) An error occurred in measure #2.
3) An error occurred in measure #3.
4) An error occurred in measure #4.
5) All measures were correct.

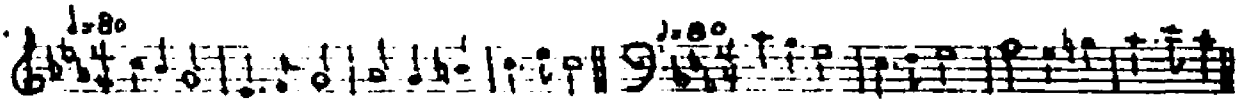
12. 1) Pair #1 was a half-step.
    2) Pair #2 was a half-step.
    3) Pair #3 was a half-step.
    4) Pair #4 was a half-step.
    5) None were half-steps.

13. 1) Example #1 is different.
    2) Example #2 is different.
    3) Example #3 is different.
    4) Both examples 1 and 3 are different.
    5. Both examples 2 and 3 are different.

14. 1) Example #1 is different.
    2) Example #2 is different.
    3) Example #3 is different.
    4) Both examples 1 and 3 are different.
    5) Both examples 2 and 3 are different.

15. 

    1) The error occurred in measure #1.
    2) The error occurred in measure #2.
    3) The error occurred in measure #3.
    4) The error occurred in measure #4.

16. 

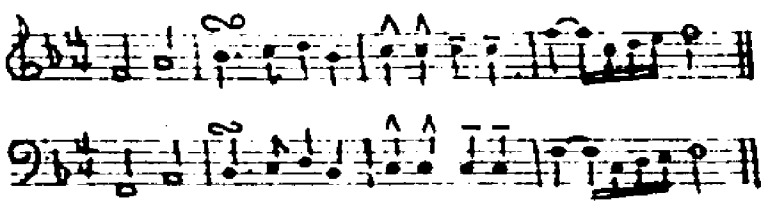
    1) The error occurred in measure #1.
    2) The error occurred in measure #2.
    3) The error occurred in measure #3.
    4) The error occurred in measure #4.

17. 1) Excerpt #1.
    2) Excerpt #2.
    3) Excerpt #3.

18. 1) Excerpt #1.
    2) Excerpt #2.
    3) Excerpt #3.

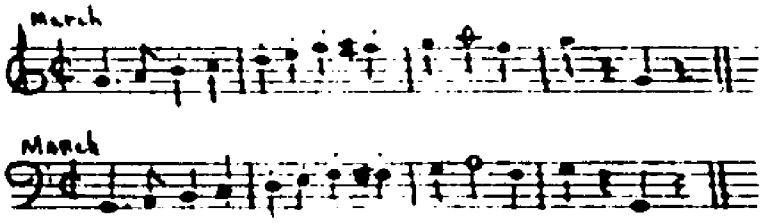
19. 1) Excerpt #1.
    2) Excerpt #2.
    3) Excerpt #3.

20.



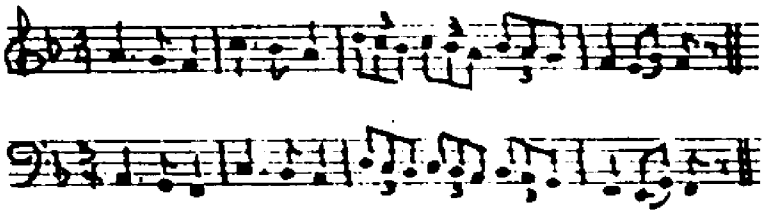
1) One measure contains errors.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

21.

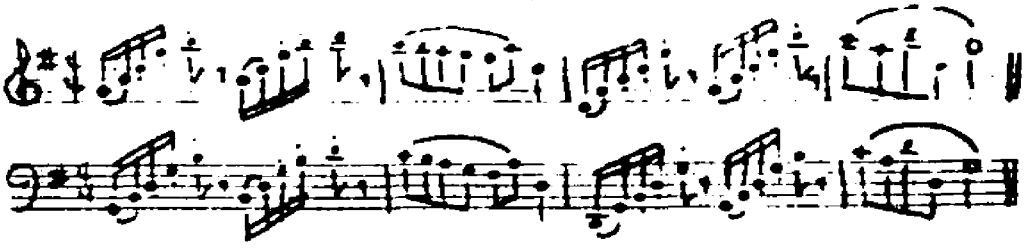


1) One measure contains errors.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

22.



1) One measure contains errors
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

23. 

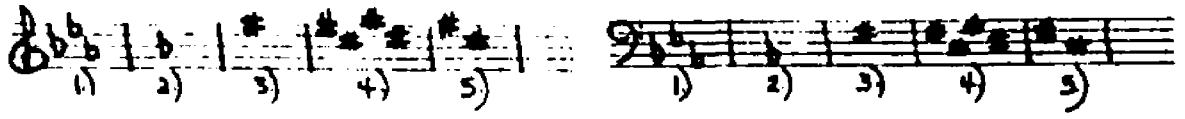
1) One measure contains errors.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) All measures are correct.

PART II. Visual

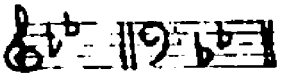
24. The key signature of A Major contains:

1) 4 flats
2) No flats or no sharps
3) 4 sharps
4) 3 sharps
5) 2 flats

25. The key signature of E Major is:

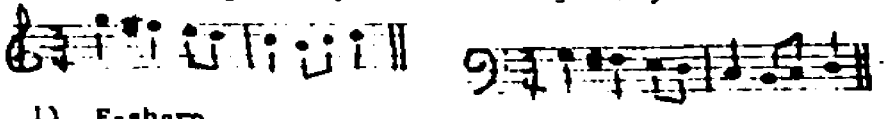


26. The following major key signature is:



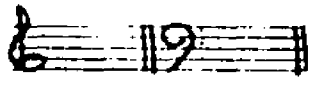
1) E-flat
2) A-flat
3) F
4) B-flat
5) None of the above

27. The following melody is in the major key of:



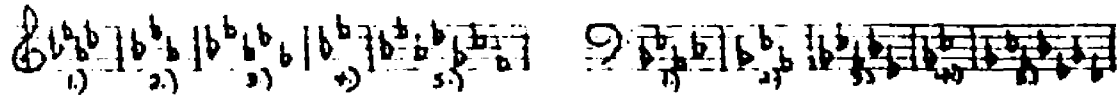
1) F-sharp
2) G
3) D
4) F
5) None of the above

28. Name the following minor key signature:

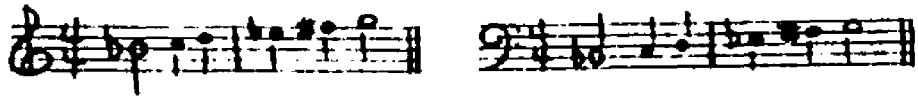


1) E
2) G
3) C
4) A
5) None of the above

29. The key signature of B-flat minor contains:

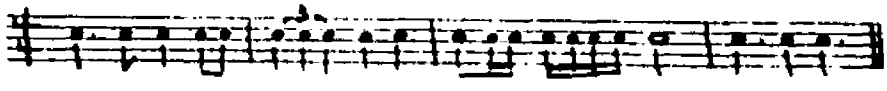


30. The following melody is in the minor key of:



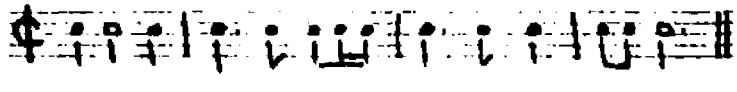
1) B-flat
2) C
3) E-flat
4) G
5) None of the above

31. Which of the following measures contain an incorrect number of beats?



1) Measure 1
2) Measure 2
3) Measure 3
4) Measure 4
5) All are correct

32. Which of the following measures contain an incorrect number of beats?

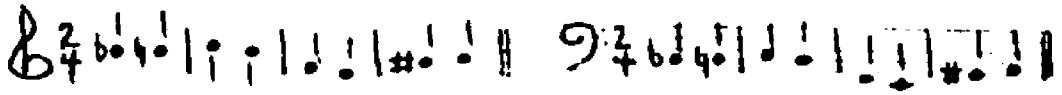


1) Measure 2
2) Measure 3
3) Measures 1 and 3
4) Measures 2 and 3
5) Measures 2 and 4

33. Which of the following measures contain an incorrect number of beats?

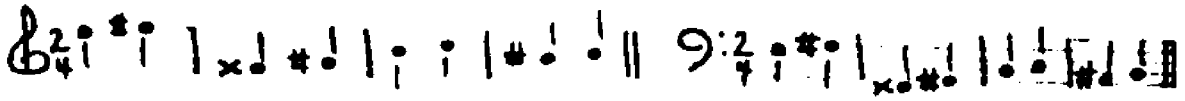
1) Measure 1
2) Measure 2
3) Measure 3
4) Measure 4
5) All are correct

34. Which measures contain half steps?



1) Measure 1
2) Measures 2 and 4
3) Measures 1 and 3
4) Measure 4
5) All are correct

35. Which measures contain whole steps?



1) Measure 1
2) Measures 2 and 4
3) Measure 3
4) Measures 1 and 3
5) None contain whole steps

36. The five major periods of music chronologically from A.D. 1450 to present time are:

1) Classical, Baroque, Renaissance, Romantic, 20th Century
2) Renaissance, Classical, Baroque, Romantic, 20th Century
3) Renaissance, Baroque, Classical, Romantic, 20th Century
4) Renaissance, Baroque, Romantic, Classical, 20th Century
5) Renaissance, Romantic, Baroque, Classical, 20th Century

37. Which of the following statements are false?

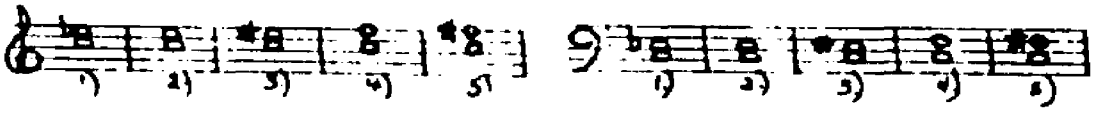
A) The interpretation of  is the same in jazz as in a march.
B) In general, the longer the note the greater the emphasis.
C) In general, as a melody ascends, the volume increases.
D) Music that is soft is usually slower than that which is loud.

1) Items A and C
2) Items B and C
3) Items A and B
4) Items C and D
5) Items A and D

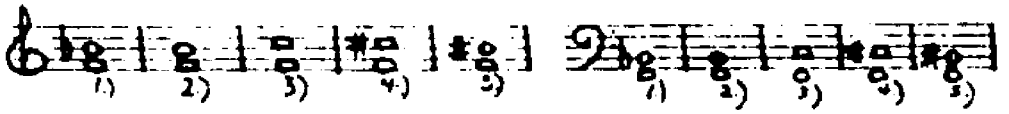
38. Which of the following composers would you more likely associate with a fugue?

1) Mozart
2) Beethoven
3) Bach
4) Bernstein
5) None of the above

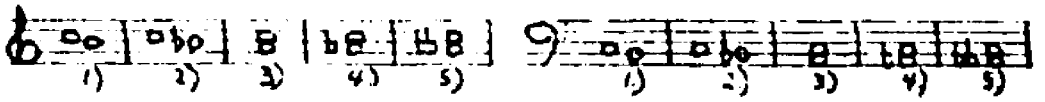
39. Which note is a major third above C?



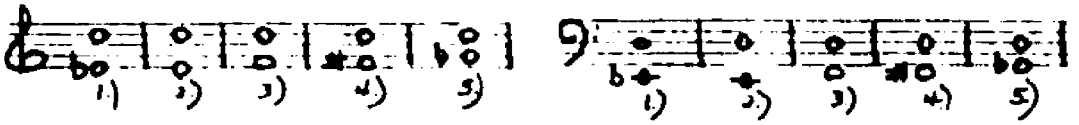
40. Which note is a perfect fourth above F?



41. Which note is a major second below C?



42. Which note is a minor sixth below D?



43. B double-flat (bb) sounds the same as:

1) A-flat
2) B
3) A
4) A-sharp
5) None of the above

44. Select the terms which most correctly describe "meno mosso e dolce."

1) More motion and softly
2) Less motion and sweetly
3) Less motion and softly
4) More motion and sweetly
5) Less volume and sweetly

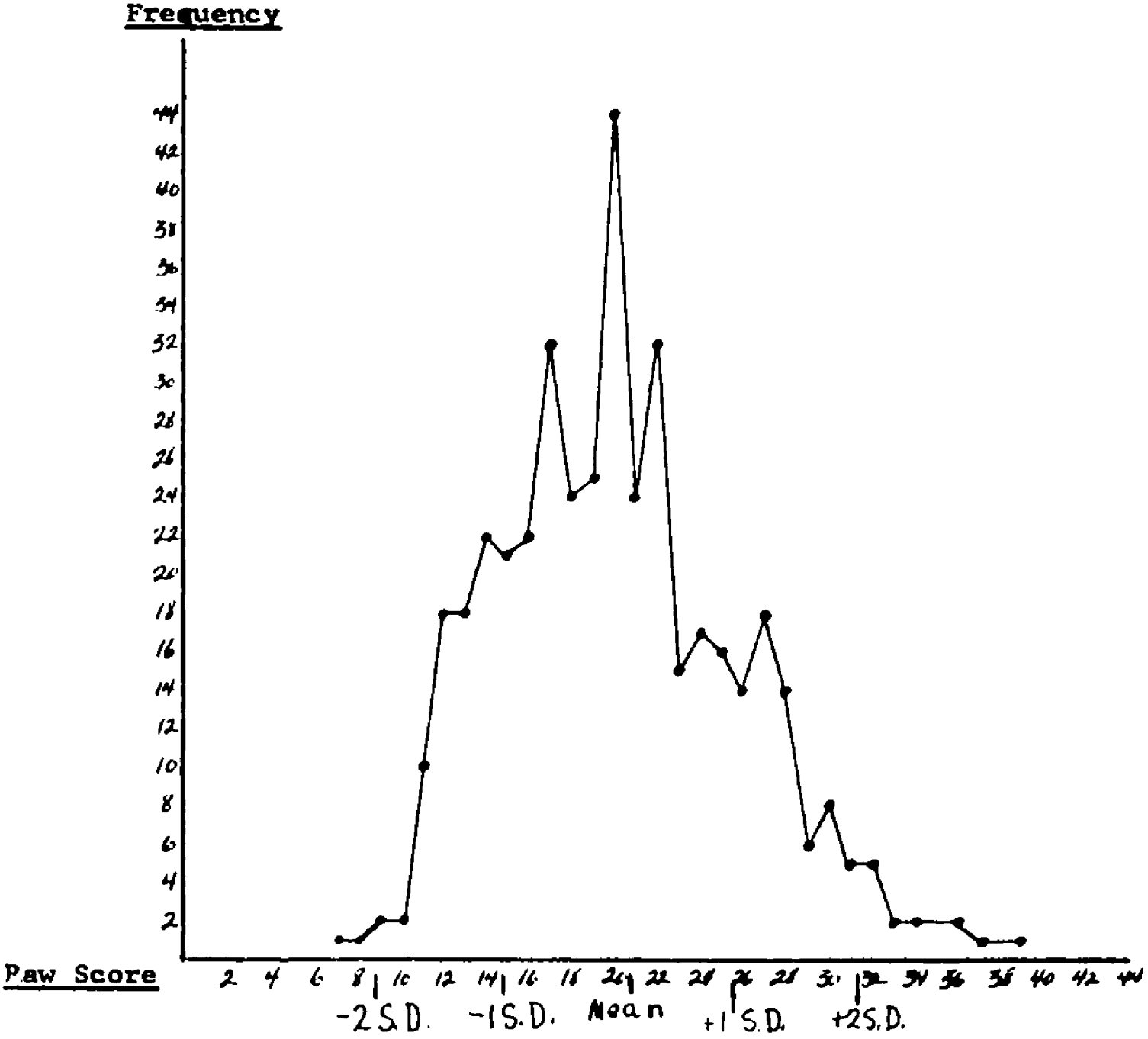
45. Select the terms which most correctly describe "poco a poco ritard e morendo."

1) Much more slowly and dying out
2) Slow down little by little and dying out
3) Slow down little by little and becoming louder
4) Speed up little by little and becoming louder
5) Suddenly slower and dying out

46. Select the terms which most correctly describe "allegro, pui pesante."

1) Moderately fast with heaviness
2) Very fast with heaviness
3) Moderately fast without passion
4) Very fast without passion
5) Moderately fast without heaviness

FREQUENCY DISTRIBUTION--PILOT NO. 2



N = 424
Mean = 20.12
Median = 19.88
Mode = 20
S. D. + 5.63

ITEM DIFFICULTY AND DISCRIMINATION INDICES
PILOT TEST NO. 2

Item	Item Difficulty	Item Discrimination
1	62	17
2	80	3
3	86	10
4	84	13
5	56	11
6	68	22
7	44	11
8	65	14
9	5	11
10	38	35
11	30	17
12	25	23
13	53	32
14	38	31
15	75	36
16	59	17
17	52	31
18	16	18
19	17	- 5
20	52	21
21	61	18
22	73	- 1
23	59	24
24	44	46
25	33	61
26	28	48
27	51	61
28	72	48
29	70	48
30	81	33
31	82	33
32	46	43

(Continued)

Item	Item Difficulty	Item Discrimination
33	44	44
34	55	67
35	57	71
36	75	20
37	73	21
38	65	49
39	49	71
40	77	37
41	77	38
42	78	10
43	40	55
44	66	37
45	47	40
46	80	5

APPENDIX D

PILOT TEST NO. 3 (FINAL TEST), INSTRUCTIONS FOR TAPE PREPARATION, FREQUENCY DISTRIBUTION, ITEM DIFFICULTY AND DISCRIMINATION INDICES

APPENDIX D

PILOT TEST NO. 3 (FINAL TEST), INSTRUCTIONS FOR TAPE PREPARATION, FREQUENCY DISTRIBUTION, ITEM DIFFICULTY AND DISCRIMINATION INDICES

APPENDIX D

PILOT TEST NO. 3 (FINAL TEST)

ROTH COGNITIVE AURAL-PERCEPTION MUSIC ACHIEVEMENT TEST

PART I. AURAL

INTONATION

1. Determine if the flute or clarinet is either flat, sharp or in tune with the oboe.

   1) The flute was flat.
   2) The flute was sharp.
   3) The clarinet was flat.
   4) The clarinet was sharp.
   5) Both were in tune with the oboe.

2. Determine if the violin or trumpet is either flat, sharp or in tune with the cello.

   1) The violin was flat.
   2) The violin was sharp.
   3) The trumpet was flat.
   4) The trumpet was sharp.
   5) Both were in tune with the cello.

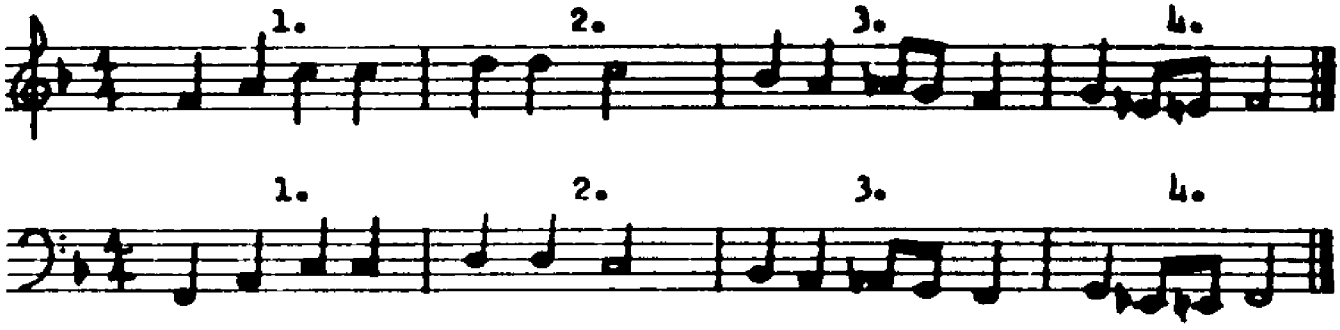
3. Determine which pitch is out of tune and whether it is flat or sharp.

   1) The bottom pitch was flat.
   2) The middle pitch was flat.
   3) The top pitch was flat.
   4) The bottom pitch was sharp.
   5) The top pitch was sharp.

4. Determine which pitch is out of tune and whether it is flat or sharp.

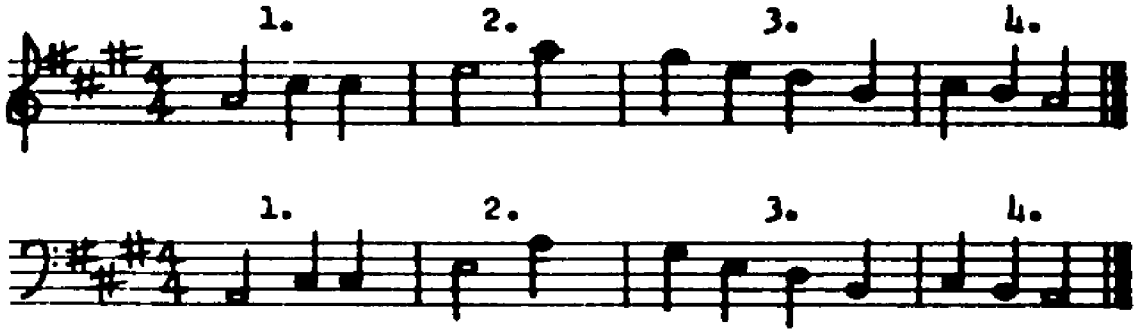
   1) The bottom pitch was flat.
   2) The middle pitch was flat.
   3) The top pitch was flat.
   4) The bottom pitch was sharp.
   5) The top pitch was sharp.

5. Determine in which measure an intonation error occurs or if all measures are correct.



1) An intonation error occurs in measure #1.
2) An intonation error occurs in measure #2.
3) An intonation error occurs in measure #3.
4) An intonation error occurs in measure #4.
5) All measures are correct.

6. Determine in which measure an intonation error occurs or if all measures are correct.



1) An intonation error occurs in measure #1.
2) An intonation error occurs in measure #2.
3) An intonation error occurs in measure #3.
4) An intonation error occurs in measure #4.
5) All measures are correct.

BALANCE

7. Determine which tone is too loud for proper balance or if they are all in proper balance.

1) The bottom tone was too loud.
2) The middle tone was too loud.
3) The top tone was too loud.
4) All three tones were in proper balance.

8. Determine which tone is too loud for proper balance or if they are all in proper balance.

1) The bottom tone was too loud.
2) The middle tone was too loud.
3) The top tone was too loud.
4) All three tones were in proper balance.

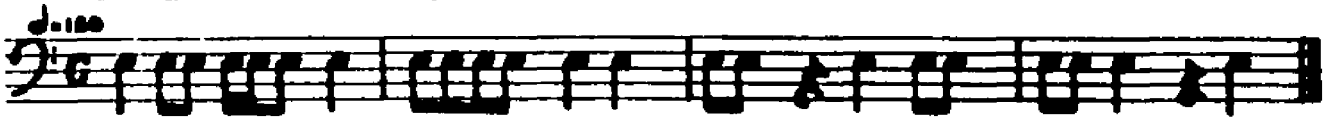
STYLE

9. Tell which excerpt is most characteristic of the Baroque Period.

1) Excerpt #1
2) Excerpt #2
3) Excerpt #3

RHYTHM

10. Determine how many measures contain rhythmic errors or if all are played correctly.

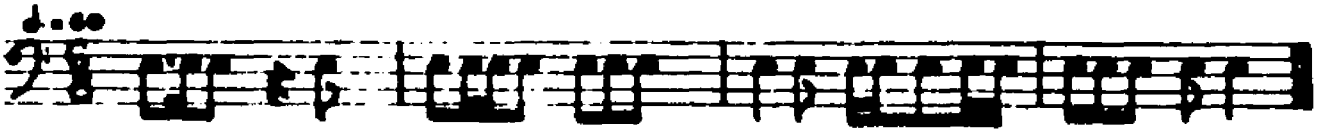


1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) All measures are played correctly.

11. Determine how many measures contain rhythmic errors or if all are played correctly.

1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) All measures are played correctly.

12. Determine how many measures contain errors or if all are played correctly.



1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) All measures are played correctly.

MELODY RETENTION

13. Determine which one or two of the transpositions differ from the original melody.

1) Example #1 was different.
2) Example #2 was different.
3) Example #3 was different.
4) Both examples #1 and #3 were different.
5) Both examples #2 and #3 were different.

14. Determine which one or two of the transpositions differ from the original melody.

1) Example #1 was different.
2) Example #2 was different.
3) Example #3 was different.
4) Both examples #1 and #3 were different.
5) Both examples #2 and #3 were different.

STYLE

15. Tell which excerpt is most characteristic of the Twentieth Century.

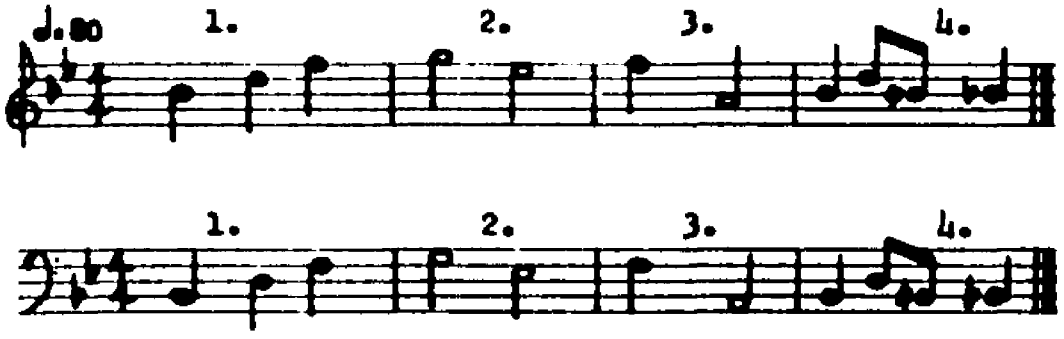
1) Excerpt #1
2) Excerpt #2
3) Excerpt #3

INTERVAL RECOGNITION

16. Tell which pair of notes contains a half-step or if there are no half-steps.

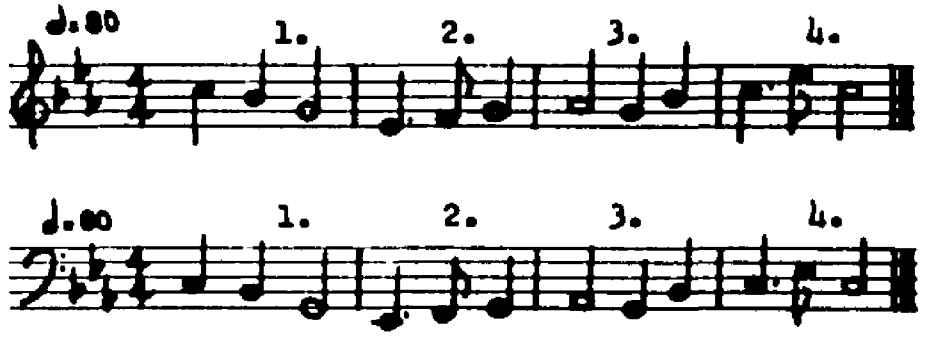
1) Pair #1 was a half-step.
2) Pair #2 was a half-step.
3) Pair #3 was a half-step.
4) Pair #4 was a half-step.
5) None were half-steps.

17. Tell in which measure the interval error occurs.



1) The interval error occurs in measure #1.
2) The interval error occurs in measure #2.
3) The interval error occurs in measure #3.
4) The interval error occurs in measure #4.

18. Tell in which measure the interval error occurs.



1) The interval error occurs in measure #1.
2) The interval error occurs in measure #2.
3) The interval error occurs in measure #3.
4) The interval error occurs in measure #4.

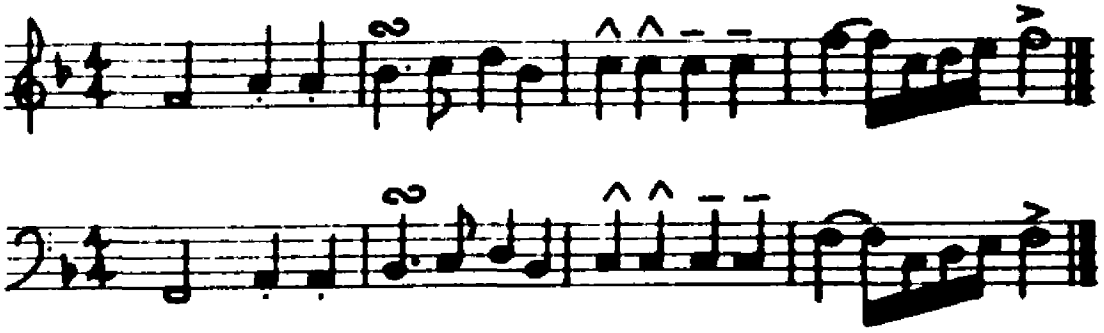
STYLE

19. Tell which excerpt is most characteristic of the Romantic Period.

1) Excerpt #1
2) Excerpt #2
3) Excerpt #3

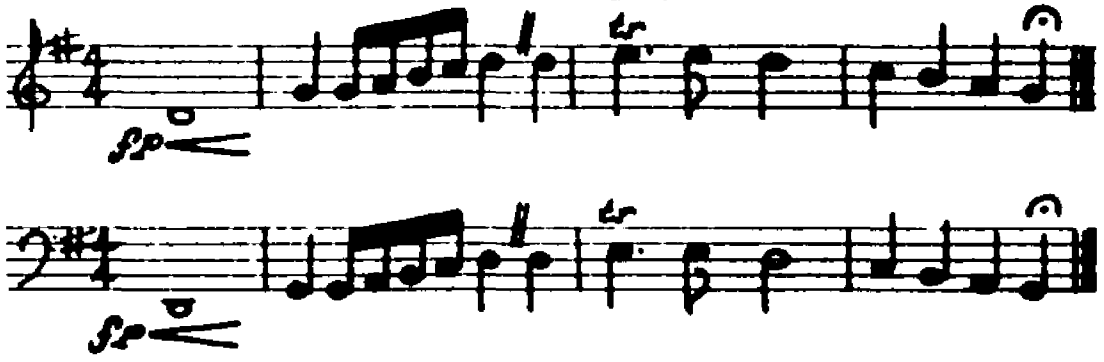
INTERPRETATION OF MUSICAL NOTATION

20. Determine how many measures contain errors in performance or if all measures are played correctly.



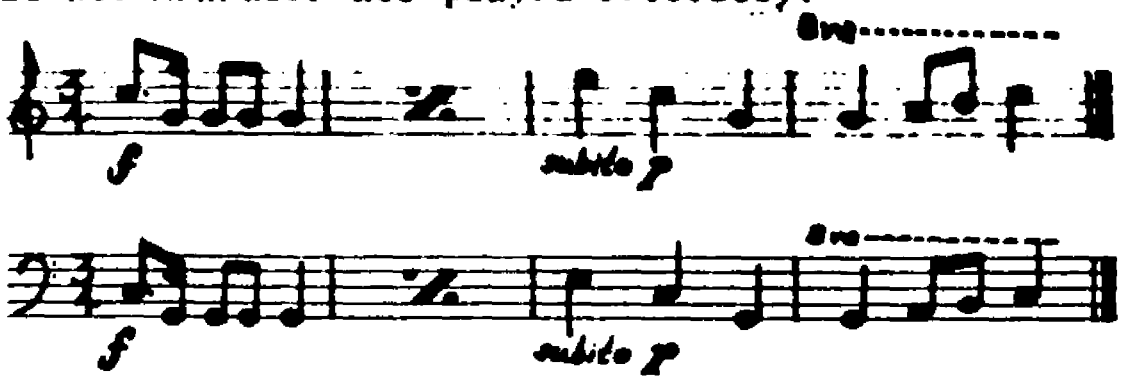
1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

21. Determine how many measures contain errors in performance or if all measures are played correctly.



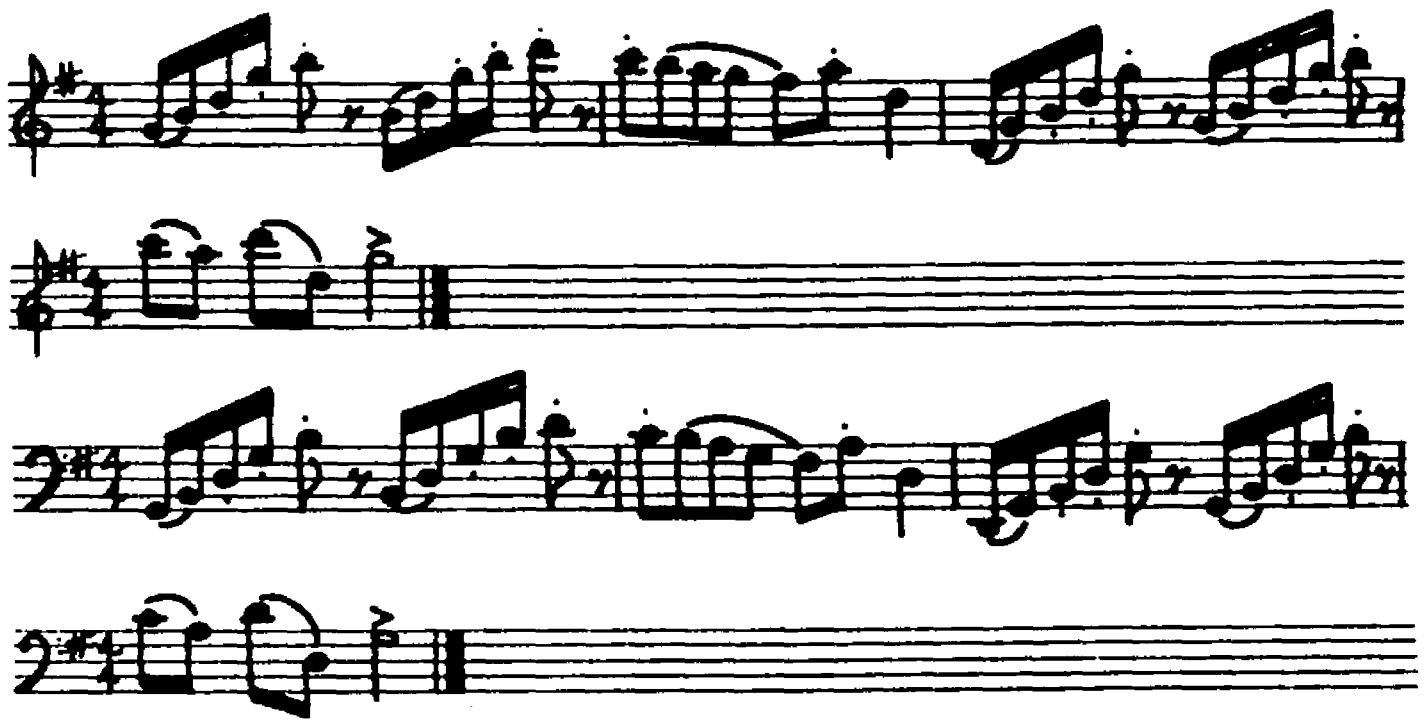
1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

22. Determine how many measures contain errors in performance or if all measures are played correctly.



1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

23. Determine how many measures contain errors in performance or if all measures are played correctly.



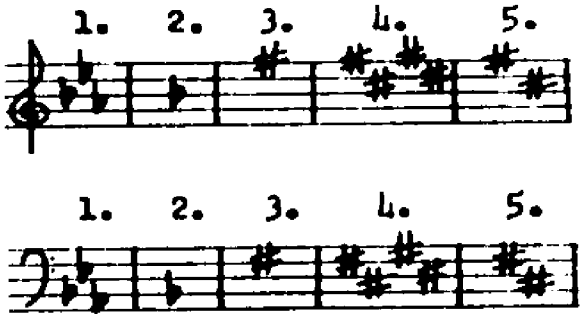
1) One measure contains an error.
2) Two measures contain errors.
3) Three measures contain errors.
4) Four measures contain errors.
5) No measures contain errors.

PART II. VISUAL

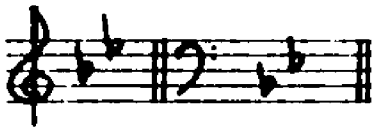
24. The key signature of A major contains:

1) 4 flats
2) No flats or sharps
3) 4 sharps
4) 3 sharps
5) 2 flats

25. The key signature of E major is:



26. The following major key signature is:

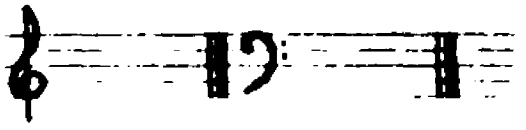


1) E-flat
2) A-flat
3) C
4) B-flat
5) None of the above

27. The following melody is in the major key of:

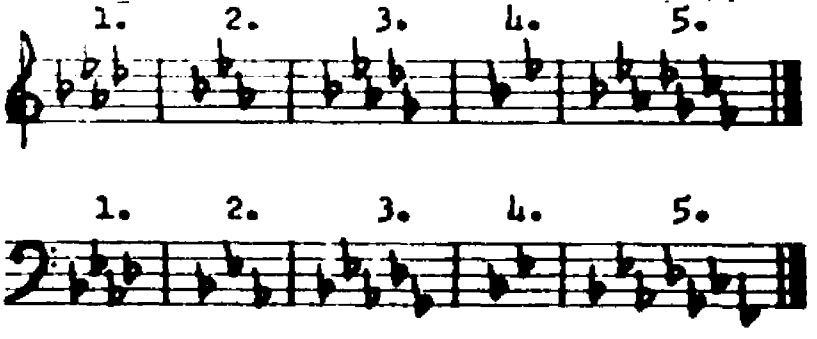
1) F-sharp
2) G
3) D
4) F
5) None of the above

28. Name the following minor key signature:

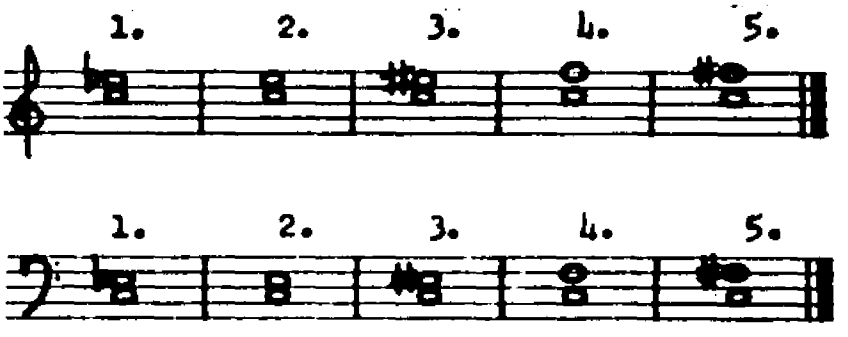


1) E
2) G
3) C
4) A
5) None of the above

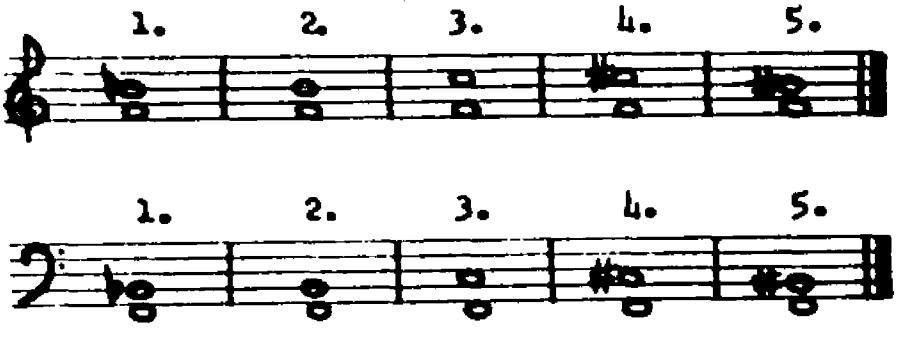
29. The key signature of B-flat minor contains:



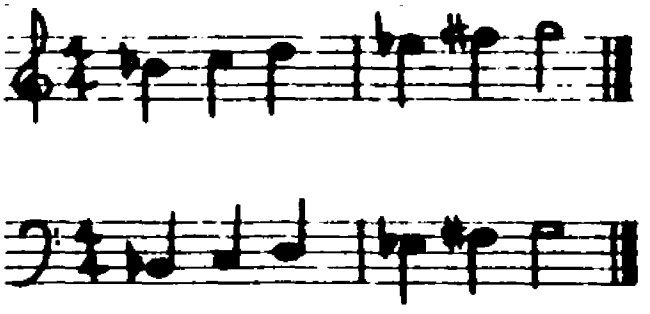
30. Which note is a major third above C?



31. Which note is a perfect fourth above F?



32. The following melody is in the minor key of:

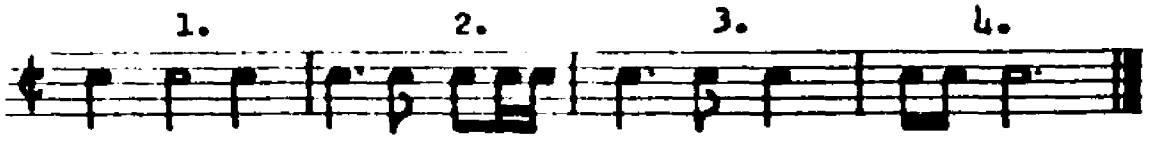


1) B-flat
2) C
3) E-flat
4) G
5) None of the above

33. Which of the following measures contains an incorrect number of beats or are all measures correct?

1) Measure #1
2) Measure #2
3) Measure #3
4) Measure #4
5) All are correct

34. Which of the following measures contain an incorrect number of beats?

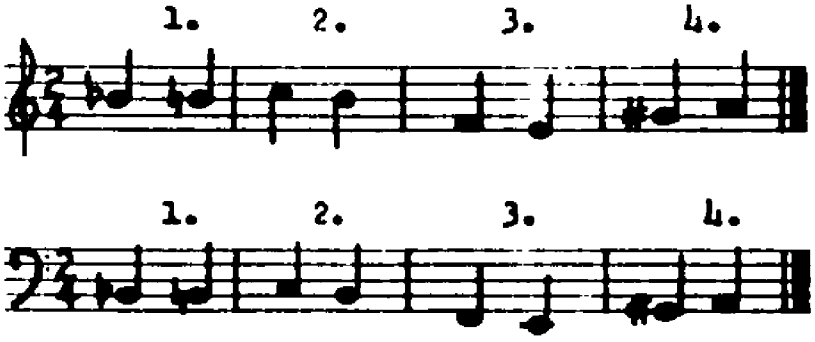


1) Measure #2
2) Measure #3
3) Measures #1 and #3
4) Measures #2 and #3
5) Measures #2 and #4

35. Which of the following measures contains an incorrect number of beats or are all measures correct?

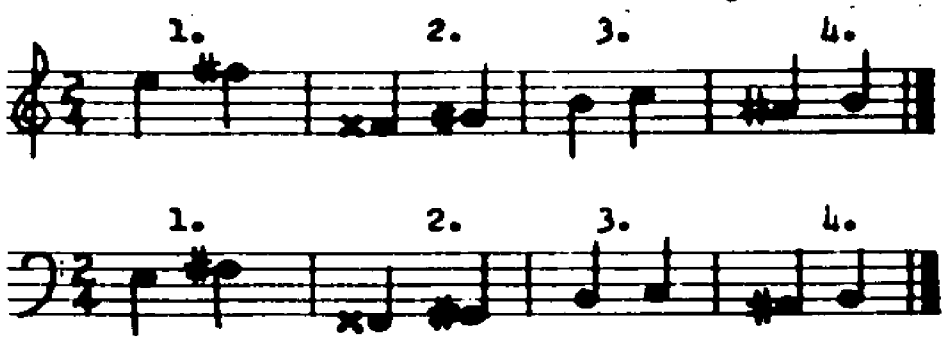
1) Measure #1
2) Measure #2
3) Measure #3
4) Measure #4
5) All are correct

36. Which measures contain half-steps?



1) Measure #1
2) Measures #2 and #4
3) Measures #1 and #3
4) Measure #4
5) All measures contain half-steps

37. Which measures contain whole-steps?



1) Measure #1
2) Measures #2 and #4
3) Measure #3
4) Measures #1 and #3
5) None contain whole-steps

38. The five major periods of music chronologically from A.D. 1450 to present time are:

1) Classical, Baroque, Renaissance, Romantic, 20th Century
2) Renaissance, Classical, Baroque, Romantic, 20th Century
3) Renaissance, Baroque, Classical, Romantic, 20th Century
4) Renaissance, Baroque, Romantic, Classical, 20th Century
5) Renaissance, Romantic, Baroque, Classical, 20th Century

39. Which of the following statements are true?

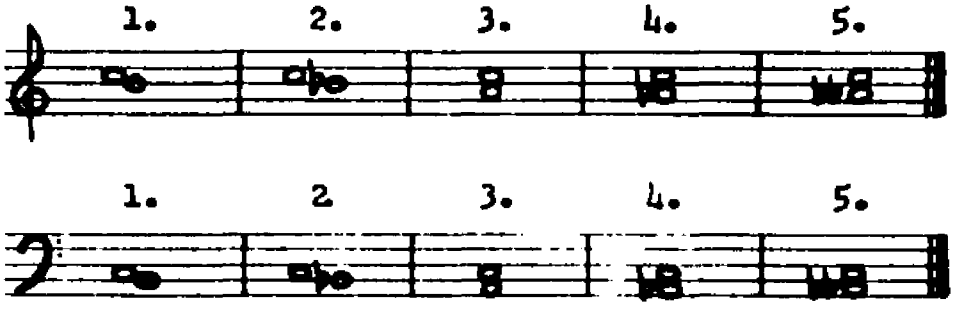
A) The interpretation of  is the same in jazz as in a march.
B) In general, the longer the note, the greater the emphasis.
C) In general, as a melody ascends, the volume increases.
D) Music that is soft is always slower than that which is loud.

1) Items A and C
2) Items B and C
3) Items A and B
4) Items C and D
5) Items A and D

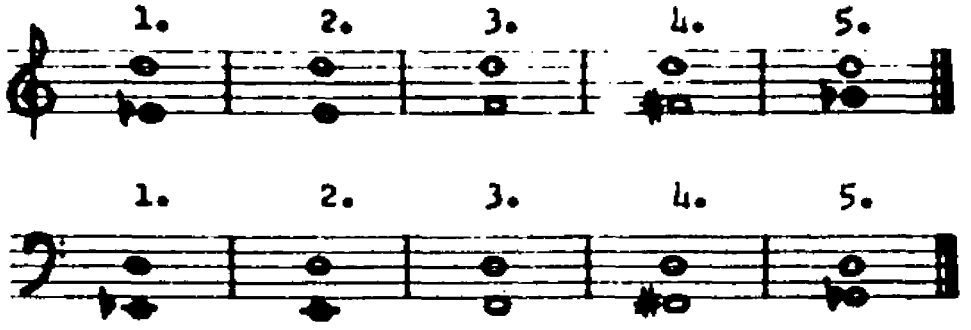
40. Which of the following composers would you more likely associate with a fugue?

1) Mozart
2) Beethoven
3) Bach
4) Bernstein
5) None of the above

41. Which note is a major second below C?



42. Which note is a minor sixth below D?



43. B double-flat (bb) sounds the same as:

1) A-flat
2) B
3) A
4) A-sharp
5) None of the above

44. Select the terms which most correctly describe "meno mosso e dolce."

1) More motion and softly.
2) Less motion and sweetly.
3) Less motion and softly.
4) More motion and sweetly.
5) Less volume and sweetly.

45. Select the terms which most correctly describe "poco a poco ritard e morendo."

1) Much more slowly and dying out.
2) Slow down little by little and dying out.
3) Slow down little by little and becoming louder.
4) Speed up little by little and becoming louder.
5) Suddenly slower and dying out.

46. Select the terms which most correctly describe "molto allegro-sempre staccato."

1) Very fast--always separated.
2) Not so fast--always separated.
3) Very fast--suddenly separated.
4) Not so fast--suddenly connected.
5) Not so fast--suddenly separated.

INSTRUCTIONS FOR TAPE

PILOT NO. 3

The test you are about to take is not one which you will pass or fail. Band and orchestra students from approximately 50 other schools throughout the state are taking the test to determine knowledge in a number of non-performance areas in music.

Answer all questions. If you are unsure about a question, select the best answer on the basis of your knowledge in music. For questions which require printed notation, both bass and treble clef examples are shown. Use the one with which you are most familiar.

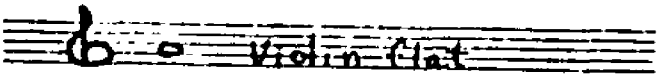
Thank you for your cooperation.

Question #1. INTONATION. You will hear a tuning note sounded by the oboe, followed by the flute and clarinet. You are to determine if the flute or the clarinet is either flat, sharp or in tune with the oboe. Here is the oboe____, now the flute and clarinet____ ____. Once again, all three ____ ____ ____. Choose one of the five answers.

Example:

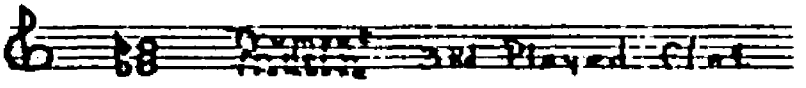
Question #2. This time the tuning note will be sounded by the cello and followed by the violin and trumpet. You are to determine if the violin or the trumpet is either flat, sharp or in tune with the cello. Here is the cello____, now the violin and trumpet____ ____. Once again, all three ____ ____ ____. Choose one of the five answers.

Example:



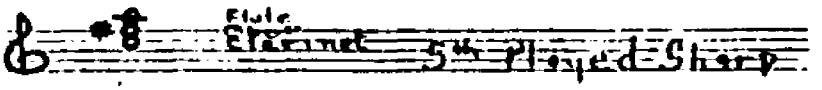
Question #3. You will hear a major chord consisting of three pitches played separately and in tune. Then you will hear the three pitches sounded together in a chord, but one of the three will be either flat or sharp. You should determine which pitch is out of tune and whether it is flat or sharp. Here are the three pitches, starting with the bottom, followed by the chord with one out of tune pitch____ ____ ____ ____. And again,____ ____ ____ ____. Choose one of the five answers.

Example:

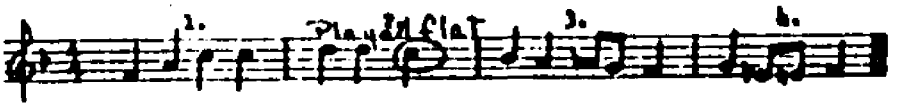


Question #4. The instructions are the same as for the previous question but with different instruments and a different chord. You should determine which pitch is out of tune and whether it is flat or sharp. Here are the three pitches followed by the chord,____ ____ ____ ____.

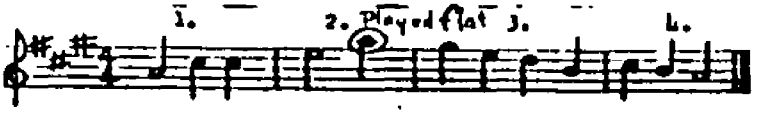
And again,____ ____ ____ ____. Choose one of the five answers.

Example: 

Question #5. Observe the following melody as you hear it played and listen for correct intonation. Determine in which measure an intonation error occurs or if all measures are correct. The melody will be played twice; this is the first time____, and again____. Choose one of the five answers.

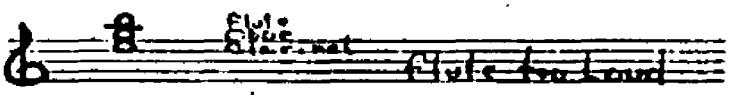
Example: 

Question #6. Observe this melody as you hear it played and listen for correct intonation. Determine in which measure an intonation error occurs or if all measures are correct. The melody will be played twice; this is the first time____, and again____. Choose one of the five answers.

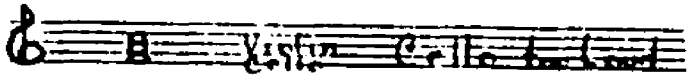
Example: 

Question #7. BALANCE. You will hear three separate tones which will comprise a minor chord. After you hear them played together, determine which tone is too loud for proper balance or if they are all in proper balance. First, the

three tones, then the chord:____ ____ ____ ____. Once again,____ ____ ____ ____. Choose your answer from the four choices.

Example: 

Question #8. The instructions are the same as in the previous question but with different instruments and the balance changed. Determine which tone is too loud for proper balance or it they are all in proper balance. First the three tones, then the chord:____ ____ ____ ____. Once again,____ ____ ____ ____. Choose your answer from the four choices.

Example: 

Question #9. STYLE. You will hear three short excerpts of compositions. Tell which excerpt is most characteristic of the Baroque Period. You will hear each excerpt once. This is excerpt #1____, excerpt #2____, excerpt #3____. Choose one of the three answers.

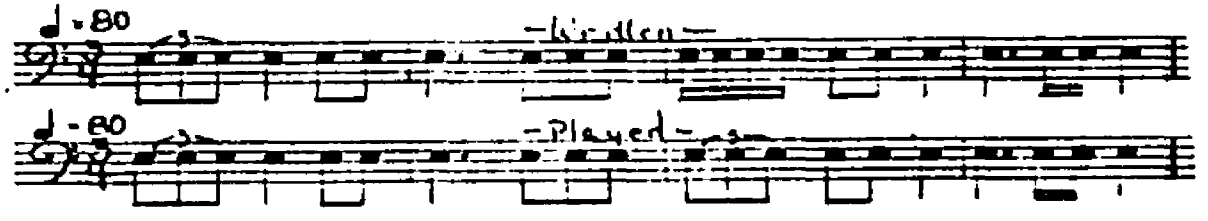
Excerpt #1: Fugue, Suite in C minor--J. S. Bach
Excerpt #2: Kleine Kammermusik--Hindemith
Excerpt #3: Divertimento #1 in B-Flat major--Haydn

Question #10. RHYTHM. You will be given ten seconds to study the following four-measure example of rhythm, then the example will be played on a snare drum. You are to determine how many measures contain rhythmic errors or it all measures are played correctly. Study the example. Here is the performance____. Once again____. Choose one of the five answers.

Example:

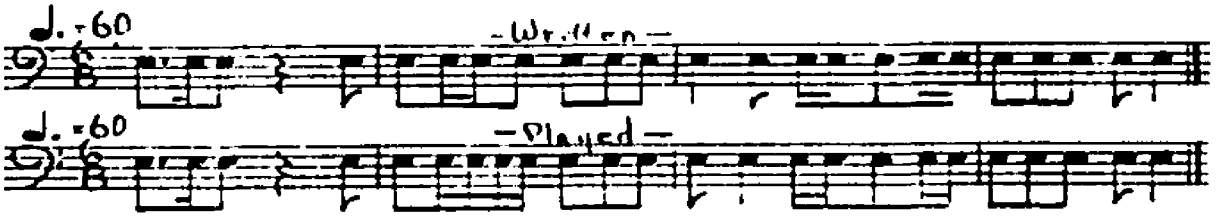
Question #11. The instructions are the same as for the previous question but with a new example. Determine how many measures contain rhythmic errors or if all measures are played correctly. Study the example for ten seconds. Here is the performance____. Once again,____. Choose one of the five answers.

Example:



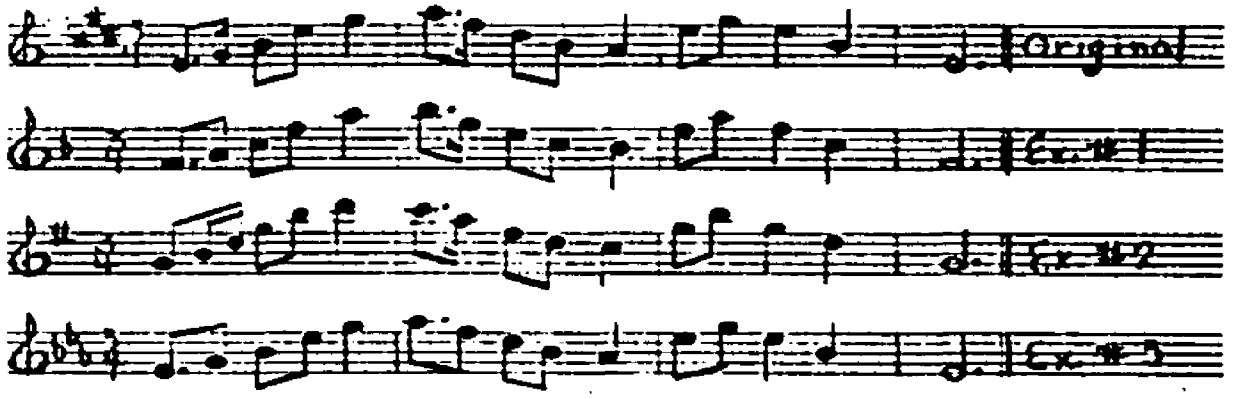
Question #12. Again the instructions are the same as for the previous two questions but with a new example. Determine how many measures contain rhythmic errors or if all measures are played correctly. Study the example for ten seconds. Here is the performance____. Once again____. Choose one of the five answers.

Example:



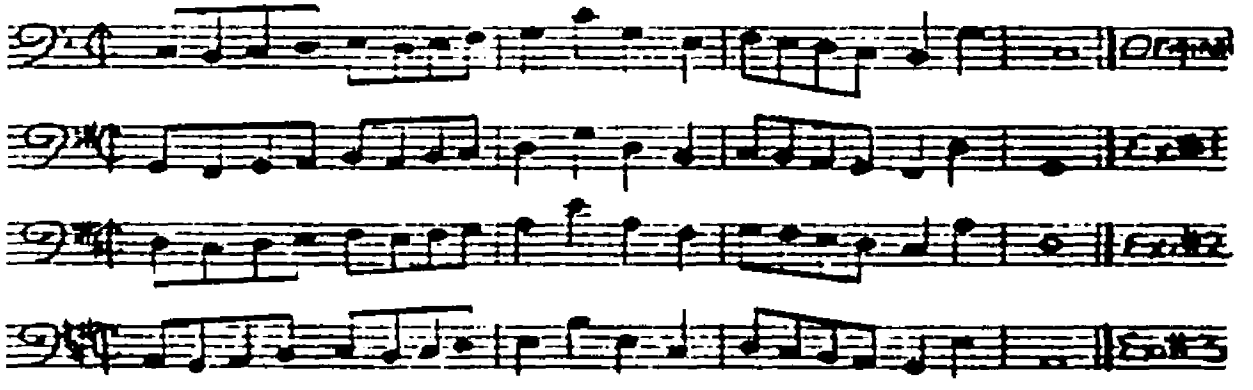
Question #13. MELODY RETENTION. You will hear a melody, then you will hear it in three different keys. You are to determine which one or two of the transpositions differ from the original melody. Each example will be played only once. Here is the original____. Here is example #1____, example #2____, example #3____. Choose one of the five answers.

Example:



Question #14. Your instructions are the same as for the previous question. Determine which one or two of the transpositions differ from the original melody. Each example will be played only once. Here is the original____. Example #1____, example #2____, example #3____, Choose one of the five answers.

Example:



Question #15. STYLE. You will hear three short excerpts of compositions. Tell which excerpt is most characteristic of the 20th century. You will hear each excerpt once. Excerpt #1____, excerpt #2____, excerpt #3____. Choose one of the three answers.

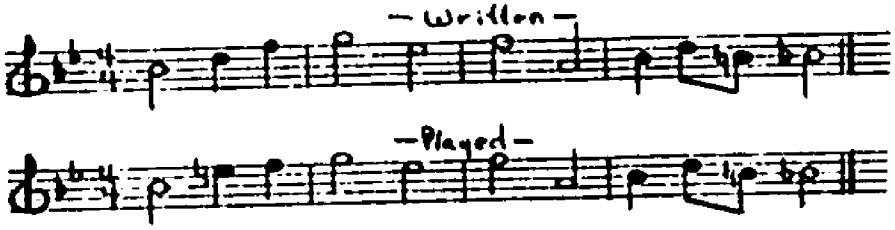
Excerpt #1: Toccata--Frescobaldi
Excerpt #2: Overture for Band--Mendelssohn
Excerpt #3: March, Divertimento for Band--Persichetti

Question #16. INTERVAL RECOGNITION. You will hear four pairs of notes either a whole-step or a half-step apart. Tell which pair contains a half-step or if there are no half-steps. First time____, and again____. Choose one of the five answers.

Example:

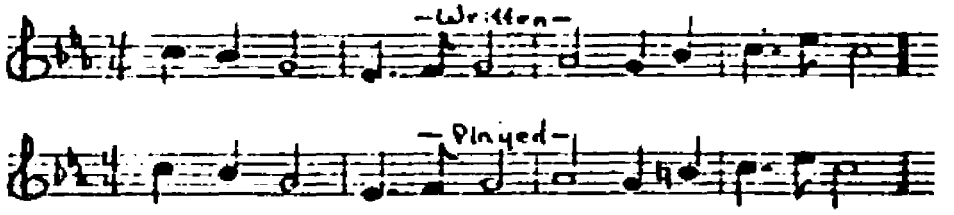
Question #17. Examine the melody. The flute will play the melody and you are to determine in which measure the interval error occurs. Here is the melody____, and again____. In which measure did the error occur?

Example:



Question #18. Examine this melody. The trombone will play the melody and you are to determine in which measure the interval error occurs. Here is the melody____, and again ____. In which measure did the error occur?

Example:



Question #19. STYLE. You will hear three short excerpts of compositions. Tell which excerpt is most characteristic of the Romantic Period. You will hear each excerpt once. This is excerpt #1____, excerpt #2____, excerpt #3____. Choose one of the three answers.

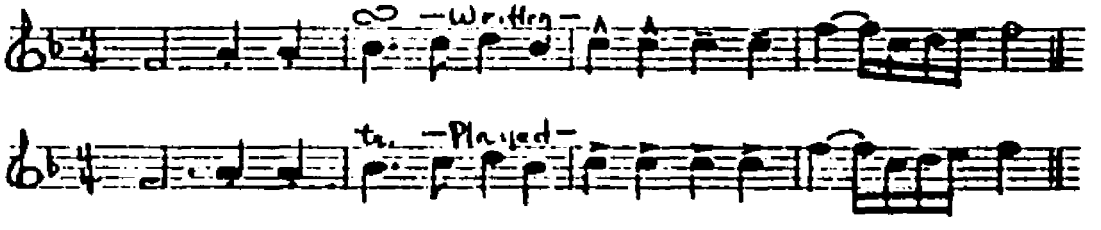
Excerpt #1: Eine Kleine Nachtmusik, 1st Movement--Mozart
Excerpt #2: Serenade for Strings, 2nd Movement--Tschaikovsky
Excerpt #3: Suite #1, Forlane--J. S. Bach

INTERPRETATION OF MUSICAL NOTATION

The following four question are concerned with correct interpretation of musical symbols. Determine how many measures contain errors in performance. Each melody will be played twice.

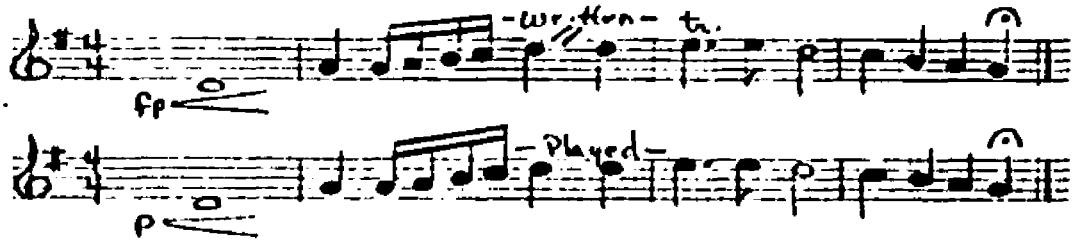
Question #20. Here is the melody____, and again____. How many measures contain errors? Choose one of the five answers.

Example:



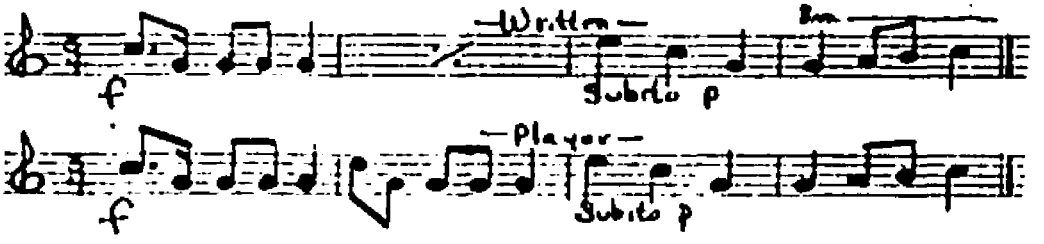
Question #21. Here is a new melody____, and again____. How many measures contain errors? Choose one of the five answers.

Example:



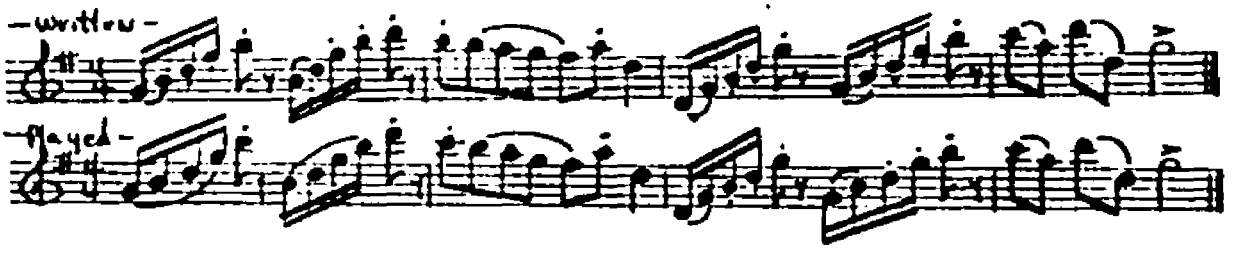
Question #22. Here is another melody____, and again____. How many measures contain errors? Choose one of the five answers.

Example:



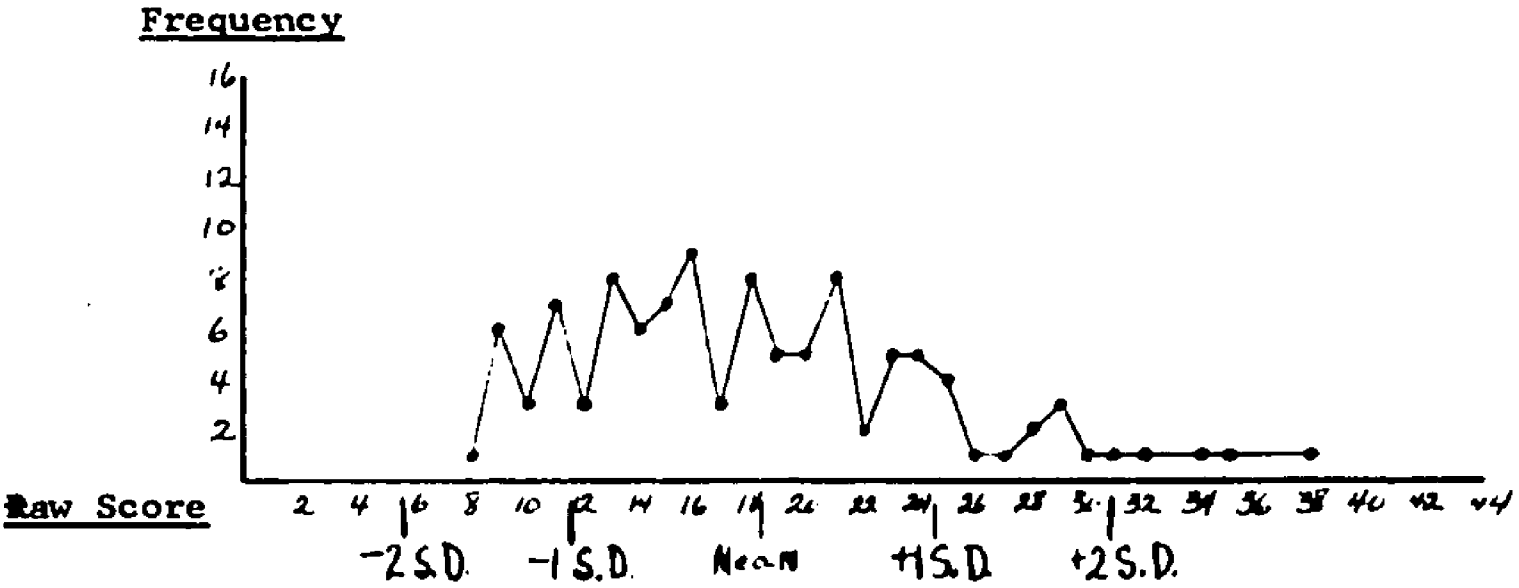
Question #23. Here is the last melody____, and again____. How many measures contain errors? Choose one of the five answers.

Example:



The remaining 23 questions do not require a tape. You will have fifteen minutes to complete them. Do not hurry. Take your time in answering. If you finish early, check your answers. You may begin with question #24.

FREQUENCY DISTRIBUTION--PILOT NO. 3



N = 111
Mean = 18.18
Median = 17.20
Mode = 16
S. D. = 6.35

ITEM DIFFICULTY AND DISCRIMINATION INDICES
PILOT TEST NO. 3

Item	Item Difficulty	Item Discrimination
1	25	28
2	69	10
3	59	24
4	70	13
5	23	52
6	33	49
7	62	13
8	14	41
9	55	45
10	54	14
11	61	52
12	68	17
13	56	21
14	50	42
15	15	24
16	71	17
17	86	10
18	33	31
19	38	3
20	59	41
21	71	45
22	88	- 3
23	67	0
24	63	38
25	62	62
26	47	41
27	55	45
28	83	38
29	77	38
30	63	44
31	82	35
32	82	21
33	81	38
34	61	65
35	46	62
36	58	66
37	68	76
38	78	24
39	68	45
40	62	32
41	79	24
42	75	7
43	55	83
44	82	14
45	55	45
46	68	35

APPENDIX E

LIST OF RANDOM NUMBERS FOR SCHOOL SELECTION PROCESS

APPENDIX E

LIST OF RANDOM NUMBERS FOR SCHOOL SELECTION PROCESS

225 Three-Digit Random Numbers

746	207	495	195	894	903	864	917	662	424	400	203	660	89	492
919	533	152	775	557	701	209	508	541	549	475	92	64	634	13
745	152	234	597	774	920	492	648	433	401	25	926	905	502	302
46	34	778	256	882	839	563	837	314	544	160	620	871	559	142
484	5	862	959	448	143	395	470	884	148	857	846	761	360	510
49	212	410	797	721	900	35	85	794	341	945	351	554	751	401
566	885	832	790	848	940	150	381	853	20	568	74	279	420	744
979	608	380	212	227	80	92	343	725	263	304	139	844	435	921
782	299	622	779	422	893	402	421	30	746	167	817	58	750	992
494	533	976	246	836	835	239	348	692	258	746	379	499	499	14
3	534	331	516	679	392	626	305	995	177	552	542	164	631	487
185	775	86	974	211	292	595	927	549	563	469	182	479	856	827
227	266	716	949	403	798	766	534	218	863	212	410	668	497	348
549	554	556	66	196	154	58	240	588	359	643	588	255	525	619
467	863	320	479	210	101	38	655	800	697	626	978	442	898	119

APPENDIX F

FORMS AND MATERIALS FOR ADMINISTRATION OF FINAL TEST

First letter sent to Michigan high schools:

MICHIGAN SCHOOL BAND AND ORCHESTRA ASSOCIATION

Dear

This letter is written to inform you that your school is one of 50 randomly selected schools in Michigan being asked to take part in a statewide test. The test is being administered to tenth, eleventh, and twelfth grade instrumental music students through the cooperation of the Michigan School Band and Orchestra Association and the Michigan Education Association. It will measure what cognitive knowledge of music our students gain from our band and orchestra rehearsals plus a number of comparisons.

Please keep in mind the following:

1. You will be asked to have your students take a 40 minute test, that requires no special equipment or "pre-teaching."

2. The test will be given by a trained test-administrator.

3. No results of the test will ever be made public. No school names will be listed, not even in the credit section. HOWEVER, IF YOU ASK, YOU CAN OBTAIN INDIVIDUAL SCORES OF YOUR STUDENTS.

All I need at this point is an indication from you that we may test your students. All other necessary information will be sent to you after we determine a mutually agreeable test date.

PLEASE FILL IN THE ENCLOSED CARD AND RETURN WITHIN FIVE (5) DAYS. THANK YOU.

Sincerely,

Raymond Roth

<u>TO THE PRINCIPAL</u>:

I sincerely hope your school will be able to take part in this test. Mr. Roth, a Ph.D. candidate at Michigan State University, has devised a test to determine results of instrumental music teaching in our schools. The questions all deal with that subject alone. Naturally, his validity

will suffer if we do not receive your cooperation. Additional information is available in the enclosed reprint from the MSBOA Journal.

Sincerely,

Bruce W. Galbraith, Managing Secretary
Michigan School Band and Orchestra Association
University of Michigan
Bureau of School Services
401 South Fourth Street
Ann Arbor, Michigan 48103 (313) 764-8242

Text of first postcard:

☐ Yes, our school will be available for testing.

☐ No, our school will not be available for testing.

Director's Signature_____

School_____

School Address_____

City and Zip_____

School Phone_____Home Phone_____

Please mail to: Ray Roth, 3636 Brentwood, Flint 48503

Text of letter sent to participating schools:

Dear Colleague:

Thank you for the positive response to my recent query regarding the statewide test. The overall response has been very cooperative and is indicative of the type of cooperation one can expect with MSBOA.

There are several points I wish to bring to your attention:

I need to know the dates your school would NOT be available for testing. Please circle those dates on the enclosed card and return to me as soon as possible. I need to begin to schedule testing dates and this is not possible until I have all the cards with all available dates.

Each student should bring a soft lead pencil on the day of the test. Ball point pens should not be used.

Since each student will have a test booklet plus an answer sheet, it would be advantageous to have a flat surface on which to write. The test need not be given in your rehearsal room--this is left to your discretion.

I shall not administer the tests personally. Test administrators (college students) are being trained for this purpose.

The test will take 46 minutes, including instructions. As you know, however, we should plan for several extra minutes to take care of unexpected situations.

There is no need to prepare your students other than for the above points. We hope to have the testing situation as normal as possible.

If you wish to receive the results of your students, please tell the administrator when he arrives at your school.

We also would like to test a control group within each school. We need your cooperation if we are to accomplish this part of the test. Our test administrator would randomly select several students from your total school population (5-10% of the total number taking the test from your school--not of the total school population--would be ample). If any of these randomly selected students had ever taken either Band, Orchestra, or Choir in high school or junior high school, they would be rejected and another student randomly chosen. It would be necessary for these students to be excused from their classes to take the test with your music students. As you can see, we need to rely heavily on you

to contact your administration on this matter. If they refuse, O.K.: we shall be without a control group from your school.

IMPORTANT

Sincerely,

Return postcard to:

Ray Roth
3636 Brentwood Drive
Flint, Michigan 48503
Phone: (313) 234-2590

Text of second postcard:

Please circle those dates in which your school will NOT be available for testing.

May 8 9 10 11 12 16 16 17 18 19

(grades 10, 11, 12 only) Time Group Meets

1st Band_____ _____

2nd Band_____ _____

Orch._____ _____

Other B/O_____ _____

Director's Signature_____

School_____

City and Zip_____

Please mail to: Ray Roth, 3636 Brentwood, Flint, 48503

CHECK LIST FOR TEST ADMINISTRATORS

1. Find the instrumental director and introduce yourself.
2. Ask to see the room where the test will be given.
3. Find out if the director wishes to know the results for his school.
4. Determine answers to Variables #58, #59, #60.
5. Check for electrical outlet and the possible location of tape recorder.
6. Ask if it is possible for a control group (10% of those taking the test would be ample).
   a. Make the random selection from main office records. Reject any student who has been a member of a junior or senior high school band, choir or orchestra.
   b. Make arrangements for these students to take the test with the band and orchestra students.
   c. If you are testing in a school for more than one hour, it is not necessary to have a control group for each hour--one will suffice.
7. As testing time approaches, be ready with: tape recorder, answer sheets and test booklets.
8. Determine the fastest, most efficient and least disturbing method of passing out answer sheets and test booklets.
9. Assure the control group they are to answer questions to the best of their ability. Control group members <u>do not</u> fill out variables 57-64.
10. Have students mark answer sheets: Names, then variables. Ask them <u>not</u> to mark test booklets.
11. Begin tape. Be <u>sure</u> they begin with answer #1.
12. When tape is completed, begin timing for a 15-minute test interval for visual part of the test.
13. Complete school information sheet.

14. Give a "three minute warning."

15. Collect answer sheets and test booklets.

16. Later--after you leave, mark in the school code number. Place answer sheets in a separate, marked envelope.

CHECKLIST OF MATERIALS NEEDED BY TEST ADMINISTRATOR

1. Answer sheets
2. Test booklets
3. Tape recorder
4. Recorder power cord
5. Extension cord
6. Take-up reel
7. Extra pencils
8. "Variables" sheet
9. School information sheet
10. Two testing tapes
11. Manila envelopes for answer sheets
12. Know the name of director and principal

VARIABLES

Item #57 If you are presently in the 10th grade, mark response #1; if in the 11th grade, mark response #2; and if in the 12th grade, mark #3.

Item #58 Mark response____. (D-#1 C-#2 B-#3 A-#4 AA-#5)

Item #59 Mark response____. (Yes-#1 No-#2)

Item #60 Mark response____. (I-#1 II-#2 III-#3 IV-#4 V-#5)

Item #61 If you presently play in this organization a brass instrument, mark response #1; if percussion, mark response #2; if woodwind, mark response #3; and if string, mark response #4.

Item #62 If you have taken ten or more private lessons on a band or orchestra instrument within the past 5 years, mark response #1; if not, mark response #2.

Item #63 If either of your parents have played in a school band or orchestra, mark response #1; if not, mark response #2.

Item #64 If you have ever taken a formal music theory course either in high school or summer camp, mark response #1; if not, mark response #2.

SCHOOL INFORMATION SHEET

Name of administrator _____

School tested _____

Address _____

City _____

Director's name _____

Number of students tested _____

Test begun at _____

Test completed at _____

Were there any unusual distractions during the test?

Yes____ No____

PLEASE RELATE

Does the director wish to know the results of his students?

Yes____ No____

What groups were tested? Band I____Band II____ Band III____

Orchestra____

Describe the attitude of the students.

Serious 1 2 3 4 5 6 7 not serious

Quiet 1 2 3 4 5 6 7 talkative

Interested 1 2 3 4 5 6 7 disinterested

Describe the attitude of the director.

Cooperative 1 2 3 4 5 6 7 not cooperative

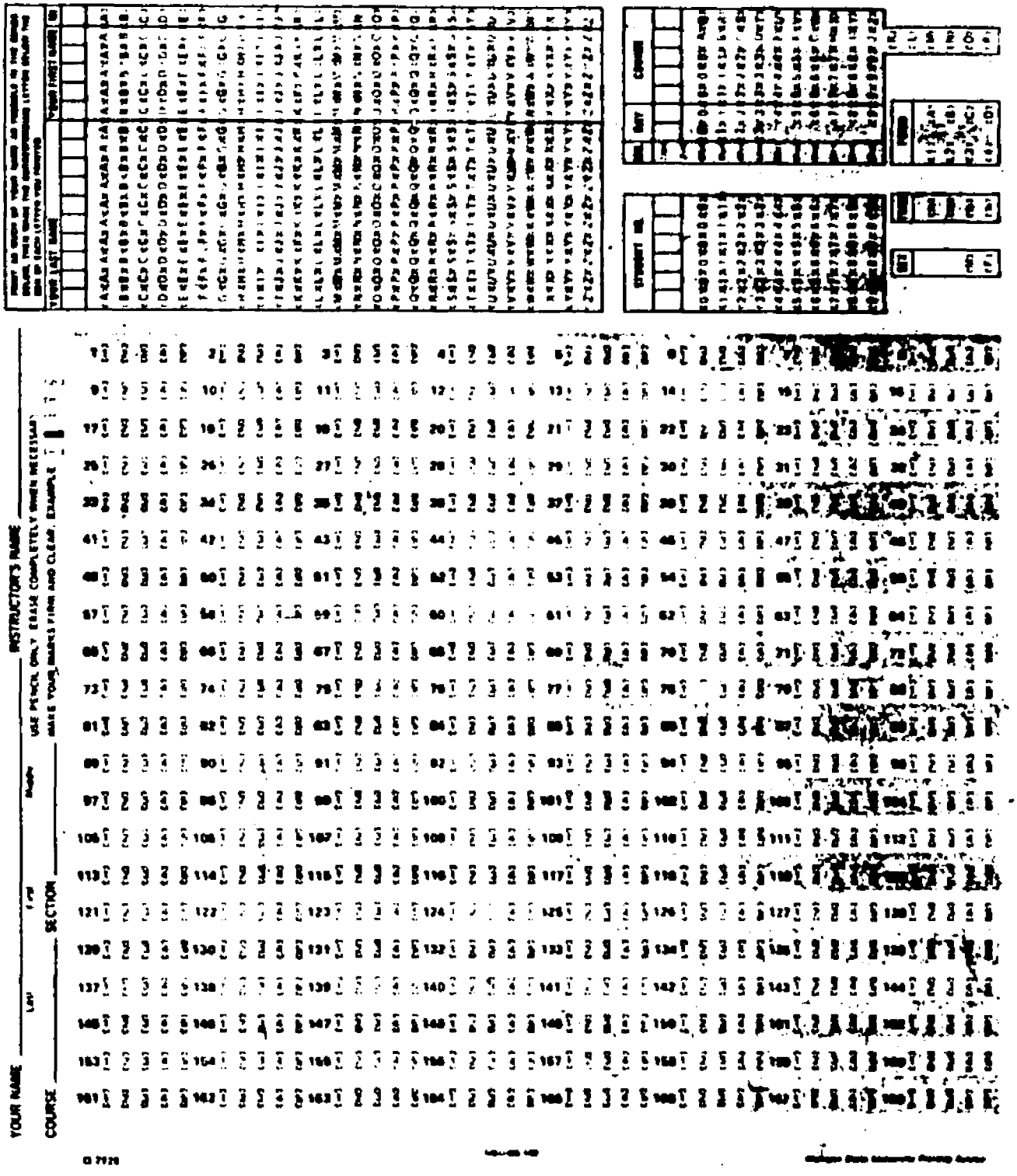
Did a control group take the test? Yes____No____

How many were in the control group? ____

APPENDIX G

SUMMARY STATISTICS--ITEM ANALYSIS OF FINAL TEST

ANSWER SHEET



APPENDIX G

SUMMARY STATISTICS--ITEM ANALYSIS OF FINAL TEST

Item Number	Index of Difficulty	Index of Discrimination	Maximum Discrimination	Discriminating Efficiency	Point Biserial Correlation	"T" of Point Biserial Correlation
1	25	35	55	63	.41	6.54
2	59	46	82	56	.44	9.57
3	68	25	65	38	.29	1.64
4	74	19	53	35	.26	.20
5	19	38	46	82	.49	9.41
6	50	45	97	46	.44	9.70
7	23	38	54	70	.46	8.87
8	32	19	69	27	.20	8.12
9	55	30	96	31	.32	3.77
10	65	20	68	29	.20	8.12
11	62	45	83	54	.47	.86
12	71	24	58	41	.30	2.09
13	48	23	97	23	.24	.22
14	39	49	81	60	.48	1.35
15	21	28	44	63	.37	4.30
16	39	47	81	58	.48	1.01
17	51	52	96	54	.51	3.32
18	40	35	81	43	.37	5.68
19	48	6	100	5	.06	2.49

(Continued)

Item Number	Index of Difficulty	Index of Discrimination	Maximum Discrimination	Discriminating Efficiency	Point Biserial Correlation	"T" of Point Biserial Correlation
20	55	31	89	34	.30	2.92
21	68	49	71	69	.54	3.93
22	58	39	89	43	.40	7.58
23	51	44	100	43	.43	9.12
24	67	49	81	60	.58	5.47
25	65	59	87	67	.68	1.63
26	51	51	95	53	.52	3.66
27	69	46	74	62	.58	5.34
28	84	29	43	67	.59	2.26
29	80	23	45	51	.44	6.55
30	67	52	80	64	.63	8.49
31	85	20	34	58	.45	5.54
32	82	22	40	54	.42	5.12
33	84	26	40	64	.53	8.78
34	50	55	97	56	.52	3.82
35	49	43	97	44	.45	9.87
36	56	58	98	59	.62	9.12
37	72	59	71	83	.74	4.78
38	77	19	51	37	.31	1.97

(Continued)

Item Number	Index of Difficulty	Index of Discrimination	Maximum Discrimination	Discriminating Efficiency	Point Biserial Correlation	"T" of Point Biserial Correlation
39	74	24	56	42	.31	2.19
40	54	43	97	44	.44	9.31
41	78	22	52	42	.37	4.12
42	82	11	37	29	.20	7.23
43	50	68	94	72	.66	2.33
44	74	15	53	28	.18	6.86
45	49	39	97	40	.40	7.34
46	63	34	76	44	.37	5.95

APPENDIX H

RESULTS OF INDIVIDUAL SCHOOLS

APPENDIX H

RESULTS OF FIFTY-ONE SCHOOLS

School	K. R. Reliability	Number of Students	Standard Error of Measurement	High Score	Low Score	Mean of School	Standard Deviation	Control Group
1	87	88	2.85	44	7	24.88	7.85	Yes
2	86	102	2.94	43	9	23.43	7.76	Yes
3	81	91	2.99	40	7	22.57	6.92	Yes
4	85	60	2.88	38	9	22.39	7.57	Yes
5	83	66	2.95	41	7	22.22	7.18	No
6	82	58	2.94	38	8	21.79	6.94	No
7	73	50	2.95	38	9	21.65	5.73	No
8	83	109	2.98	42	4	20.77	7.24	No
9	79	43	2.95	34	11	20.58	6.49	Yes
10	82	101	3.00	38	5	20.32	7.11	Yes
11	77	16	2.90	30	10	20.18	6.01	Yes
12	81	80	2.95	38	9	20.09	6.82	Yes
13	87	106	2.94	44	5	20.00	8.12	Yes
14	71	108	3.06	34	9	19.98	5.68	Yes
15	85	108	2.97	37	7	19.88	7.55	Yes
16	82	24	2.93	39	11	19.66	7.00	No
17	85	17	2.84	34	7	19.29	7.31	No
18	69	33	2.90	35	9	18.96	5.19	No
19	70	42	2.99	31	10	18.90	5.46	No
20	78	112	2.99	42	8	18.88	6.44	Yes

(Continued)

School	K. R. Reliability	Number of Students	Standard Error of Measurement	High Score	Low Score	Mean of School	Standard Deviation	Control Group
21	79	52	2.87	40	9	18.65	6.21	Yes
22	59	8	2.80	27	14	18.62	4.37	No
23	75	114	2.97	37	7	18.42	5.98	No
24	74	39	2.89	32	4	18.41	5.70	No
25	64	12	2.86	31	14	18.41	4.75	Yes
26	76	87	2.94	35	8	18.33	5.95	Yes
27	64	37	2.93	34	10	18.27	4.85	Yes
28	79	44	2.89	33	7	18.22	6.37	Yes
29	84	33	2.87	35	7	18.18	7.17	Yes
30	59	23	2.87	26	11	18.04	4.49	Yes
31	72	75	2.99	42	8	18.02	5.66	Yes
32	78	45	2.93	35	7	17.86	6.19	No
33	70	50	2.92	33	8	17.33	5.35	Yes
34	85	19	2.92	37	8	17.31	7.46	Yes
35	80	51	2.89	40	8	17.21	6.41	Yes
36	63	70	2.92	29	7	17.11	4.80	No
37	81	71	2.93	33	4	17.08	6.81	Yes
38	67	31	2.96	30	9	17.00	5.19	Yes
39	71	40	2.84	30	7	16.92	5.26	No
40	80	55	2.92	36	7	16.72	6.51	Yes

(Continued)

School	K. R. Reliability	Number of Students	Standard Error of Measurement	High Score	Low Score	Mean of School	Standard Deviation	Control Group
41	46	46	2.86	23	10	16.62	3.90	No
42	81	25	2.87	33	6	16.43	6.64	No
43	68	37	2.86	27	8	16.29	5.03	Yes
44	50	47	2.88	25	8	16.19	4.08	No
45	73	30	2.89	31	9	16.16	5.61	No
46	58	30	2.89	29	10	16.06	4.51	Yes
47	55	45	2.91	25	8	15.61	4.34	Yes
48	68	40	2.83	34	7	15.14	5.01	Yes
49	46	18	2.78	22	9	14.50	3.77	Yes
50	55	30	2.83	21	6	13.89	4.22	No
51	44	26	2.84	21	7	13.73	3.81	Yes

APPENDIX I

FACTOR ANALYSIS--FINAL TEST

APPENDIX I

VARIMAX ROTATION ANALYSIS.

ROTATION SOLUTION TIME= 11.438 SECS.

ROTATED FACTOR LOADINGS

		FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10
1	VAR.	1	.2478	.0079	.4916*	-.3563	.1222	.2443	-.0884	.1319	.0698	-.0176
2	VAR.	2	-.3492	.0736	-.4711*	.0998	.0178	.0794	.2242	-.0918	-.0513	-.0490
3	VAR.	3	-.1491	.1376	-.6542	.0241	-.7193*	-.0423	.1198	.0293	-.0144	.0052
4	VAR.	4	.1146	-.1721	.0492	.0772	-.7024*	-.0683	.0215	.0459	.0247	.0210
5	VAR.	5	.0252	.0255	-.5695*	-.1954	.0443	.0268	.0155	.0382	.0377	-.0998
6	VAR.	6	-.0437	.0178	-.0243	.0811	-.0951	-.0427	.0928	.1110	.0265	.0399
7	VAR.	7	.0677	.1412	-.2417	-.1115	-.1423	-.0274	.5195*	.0375	.0896	.0441
8	VAR.	8	.3568	.1845	-.0395	-.1175	.1543	-.5634*	-.0328	.1197	.1478	.0185
9	VAR.	9	-.1194	.0545	.0209	-.0295	-.1168	.0634	.1149	.1333	-.0388	.0750
10	VAR.	10	.0740	-.0676	.2755	.0271	-.0949	-.1494	.0471	-.2287	.0164	-.1815
11	VAR.	11	-.1435	.0743	-.1374	-.0491	-.1519	-.0491	.3378	.1214	.1756	.0855
12	VAR.	12	-.2243	.0616	-.0447	-.0345	-.1871	.1184	.2538	.1848	.0252	.1484
13	VAR.	13	.0947	-.0748	.2195	.2820	-.2169	.0595	.0638	-.0771	-.0798	.4184*
14	VAR.	14	.1292	-.1919	.4654*	-.3520	.1316	.8772	.0977	.1676	-.0764	-.0899
15	VAR.	15	.2717	.0441	.1448	.2179	.1454	.2695*	.0862	.2711	.2278	.0712
16	VAR.	16	-.0591	-.0253	-.0114	.0225	-.1173	-.0174	.8992*	.0832	-.0194	-.0193
17	VAR.	17	-.1605	.1954	-.1821	.1293	.1355	.0113	.3348*	-.1894	.0463	-.0869
18	VAR.	18	.0795	-.0706	.0173	.0246	.1837	.0434	-.0899	-.0298	.0357	-.0691
19	VAR.	19	.0371	.0897	.0135	-.0205	-.0181	-.0191	.0958	.0319	.0161	-.0592
20	VAR.	20	.1515	-.1512	-.1213	-.1569	.1314	-.0794	-.0895	.0393	.4191*	.0769
21	VAR.	21	-.0228	-.0971	.0815	-.1373	.0478	-.0249	-.0831	.1918	.0597	-.0134
22	VAR.	22	.0252	-.0694	.0385	.0972	.0332	.0086	-.0819	.4052*	-.0715	-.0893
23	VAR.	23	-.3843*	.0186	-.2734	-.2826	-.0189	.0294	-.0276	.0538	.2338	.1975
24	VAR.	24	.3178	-.1438	.0928	-.3439*	-.1847	.0728	-.2263	-.2588	.2184	-.0901
25	VAR.	25	-.5829*	-.0842	.0369	-.1279	.0264	-.0381	-.1332	.1886	-.0608	-.0893
26	VAR.	26	.0235	-.1238	-.0532	.0564	.1852	-.1355	.0869	.4089*	.0183	.1339
27	VAR.	27	.0363	.0893	-.1328	.1324	-.0587	.0662	.0837	.0302	.0824	-.7048*
28	VAR.	28	-.3339	-.0892	.0152	-.4990*	-.0927	-.0763	.0971	-.0953	-.0208	.1204

			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
29	V[illegible],	29	-.1271	.1823	.1832	.0114	-.0516	.0077	.6531	.2145	.0577	-.0456
30	V[illegible],	30	-.3199	.6937*	-.0594	-.0398	-.0473	.0336	.0017	.0074	.0649	-.0741
31	V[illegible],	31	-.3042	.5634*	-.3861	.1174	-.0879	-.0196	.1331	-.0467	.0498	.0192
32	V[illegible],	32	.3241*	.1455	.2571	-.0441	.0674	.0125	.1250	-.0443	.0156	.1004
33	V[illegible],	33	.5244*	-.1595	-.3219	.2169	.1839	.0582	.0661	-.0419	.0937	.0819
34	V[illegible],	34	.0447	.0496	.1505	.0327	-.0121	-.1514	-.1188	-.0810	.0219	-.3358
35	V[illegible],	35	.1714	.1359	.0823	.3346	.3252	.3153*	-.0852	.0895	-.0145	.2404
36	V[illegible],	36	.3403*	-.3151	.1596	.0859	-.0898	-.1696	.0984	.3169	-.1865	-.1212
37	V[illegible],	37	-.4033*	.1896	-.0872	-.0778	.0843	.1116	.1623	-.0458	.0409	-.0194
38	V[illegible],	38	-.0365	.0731	-.1101	.0179	.0598	.0177*	-.1885	.0378	-.0860	-.0708
39	V[illegible],	39	-.2219	.1571	.0361	-.0878	-.0179	-.1989	-.0880	.0898	-.0289	-.0298
40	V[illegible],	40	.1485	.1026	-.1478	.0319	-.0761	.0103	-.6625	.1023	-.0111	-.0307
41	V[illegible],	41	-.1490	.5974*	.0493	.0328	-.0403	-.1422	.0174	-.0871	.0037	.0037
42	V[illegible],	42	-.0292	-.1291*	.1193	.1442	-.0894	-.0576	.0338	-.0219	.3339	.0034
43	V[illegible],	43	-.1494	.0113	.1313	-.3686*	.0378	.2916	.2599	.0099	.1472	-.2893
44	V[illegible],	44	-.0647	-.1273	.0767	.0579	-.0876	.0111	.0873	.0092	-.7170*	.0004
45	V[illegible],	45	-.0275	.1387	-.0029	.0405	.0148	-.0294	.1009	-.1074	-.1692	-.0804
46	V[illegible],	46	-.1015	-.1333	.0993	.0014	.0377	-.2196	.1414	.0819	-.0271	.0650
47	[illegible]		.5244	.0937	-.3695	-.6894	-.7123	.9674	.6882	.4055	-.7170	-.7847
48	[illegible]		.0353	.1354	.0341	.6243	.0265	.0257	.0298	.0261	.0246	.0250
49	[illegible]		.0385	.0723	.1674	.1319	.1599	.1656	.2192	.2412	.2658	.2988

	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14	FACTOR 15	FACTOR 15	FACTOR 17	COMM.
1 VAR. 1	-.1242	-.1998	.0044	.0778	.0302	-.0599	.1870	.3977
2 VAR. 2	.0443	.1792	-.0942	-.0175	.1571	.0935	.1329	.3599
3 VAR. 3	.0572	-.0243	.0543	.0757	.1058	-.0772	.0138	.5588
4 VAR. 4	.0273	-.0397	.0473	.0723	.0491	-.0385	.0742	.5497
5 VAR. 5	-.1924	-.1286	.1431	.0272	-.0317	-.2412	-.1999	.4941
6 VAR. 6	[illegible]	-.1181	.0295	[illegible]	-.0972	-.1269	-.0940	.5329
7 VAR. 7	-.0273	-.1643	.0843	.0364	.0919	-.0532	-.0500	.4139
8 VAR. 8	.2412	-.3482	.1274	-.0173	-.0442	.0343	-.1304	.5210
9 VAR. 9	.0654	.1276	.1474	.0773	.4347*	-.1454	-.0338	.5459
10 VAR. 10	-.1043	-.0134	.1736	.0172	.0759	.2574	-.3528*	.4327
11 VAR. 11	-.0763	-.2713	-.2047	-.0211	.3315*	-.2462	.1075	.5890
12 VAR. 12	.1173	.1569	.0432	.0777	-.5677*	-.1541	-.0909	.5766
13 VAR. 13	-.0242	-.1376	.2713	.1674	.0024	.1917	.0029	.4767
14 VAR. 14	-.0776	-.3143	-.0749	-.0071	.1127	.0313	-.0785	.3150
15 VAR. 15	-.0723	-.1293	.0356	.0215	-.2743	.1643	.1953	.4042
16 VAR. 16	.0257	.0148	.0216	.0273	-.1245	.0181	.0074	.5043
17 VAR. 17	.0771	-.1100	.0356	-.1522	.0310	-.0952	-.0249	.2737
18 VAR. 18	.0045	-.0210	-.1037	.7521*	-.0087	.0163	.0280	.5905
19 VAR. 19	-.0215	.0623	.7452*	-.0336	.0642	.0517	.1000	.5901
20 VAR. 20	-.3466	-.6948	.0093	-.1637	.3018	-.1930	-.1090	.4710
21 VAR. 21	.0642	.1445	.2455	-.1277	-.1699	.6447*	.0843	.4979
22 VAR. 22	.3374	.4835	.0957	-.0526	.0222	.3643	-.0339	.4765
23 VAR. 23	.3399	.0794	.0363	.1772	.0520	-.2524	.0123	.3090
24 VAR. 24	.1431	-.3490	-.0454	.1742	-.1221	-.1034	.1790	.5246
25 VAR. 25	.0891	-.0897	.0110	.1753	-.0429	.1123	.0003	.3768
26 VAR. 26	-.1101	.2894	-.1703	.1038	.0071	.2099	-.2900	.4009
27 VAR. 27	-.3043	-.3192	.0914	.0710	.0054	.0545	-.0090	.5090
28 VAR. 28	-.1273	.1010	.0187	.0125	-.0000	.1597	.0793	.5776
29 VAR. 29	-.5314*	.0227	.0297	-.1452	-.1871	-.1702	-.0002	.4538

		(11)	(12)	(13)	(14)	(15)	(16)	(17)	Comm.
33	V44,	33	.2947	-.0371	-.0898	-.2159	.7501	+.0457	+.0059	.9299
34	V45,	34	-.2123	-.3837	.0291	-.1273	.0844	.0983	.0893	.4088
35	V46,	35	.1139	.2146	.3653	-.1166	.0874	+.0995	+.3011	.3338
36	V47,	36	-.2249	.1790	.3427	.2469	.2167	+.8723	+.1884	.3396
37	V48,	37	.1148	-.8690+	.1659	.3715	.2846	+.0039	+.0852	.3748
38	V49,	38	-.0016	.0252	.2653	-.0838	-.7378	-.2417	.1672	.4466
39	V50,	39	.0231	.3350	-.0551	-.0313	-.0142	.0364	.1899	.3899
40	V51,	40	.1671	-.3847	.9157	.0372	-.0108	.0482	.0845	.3793
41	V52,	41	.2276	.1134	.3425	.0186	-.0717	+.1480	+.1557	.5579
42	V53,	42	.1015	-.2766+	.1268	-.0629	-.3895	.0100	.2444	.4386
43	V54,	43	.0140	-.0459	-.1048	-.0621	-.0589	+.0725	+.7178+	.9738
44	V55,	44	-.1642	.2497	.1211	.8483	+.9138	+.1432	+.1896	.4475
45	V56,	45	-.0212	-.1289	.0893	-.1935	-.0170	+.8626	+.1234	.9039
46	V57,	46	.1765	-.1496	-.0819	-.1587	.1499	+.1229	+.1921	.9628
47	V58,	47	.0133	-.1171	+.0378	.0224	-.0139	+.0165	.0349	.9886
48	V59,	48	.0154	+.3359+	-.3373	.1175	.0652	-.0877	+.1185	.3624
49	V60,	49	-.1157	-.2852	-.2137	.3942+	.8981	-.1851	-.8274	.4968
50	V61,	50	.4099	-.3746	.7459	.7531	.6347	.6449	+.7178	
51	V62,	51	.8255	-.8292	-.8242	.8245	-.8258	.8249	.8292	
52	V63,	52	.7163	.9454	.3697	.3944	.4194	.4443	.4896	

PROBLEM NO. 1 COMPLETED. TOTAL TIME= 71,844 SECS.