8228842

Ellis, Donald Leslie

DIFFERENCES IN MUSIC ACHIEVEMENT AMONG GIFTED AND TALENTED, AVERAGE, AND EDUCABLE MENTALLY HANDICAPPED FIFTH- AND SIXTH-GRADE STUDENTS

The University of North Carolina at Greensboro ED.D. 1982

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

PLEASE NOTE:

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

1. Glossy photographs or pages ______
2. Colored illustrations, paper or print ______
3. Photographs with dark background ______
4. Illustrations are poor copy ______
5. Pages with black marks, not original copy ______
6. Print shows through as there is text on both sides of page ______
7. Indistinct, broken or small print on several pages __√__
8. Print exceeds margin requirements ______
9. Tightly bound copy with print lost in spine ______
10. Computer printout pages with indistinct print ______
11. Page(s) __________ lacking when material received, and not available from school or author.
12. Page(s) __________ seem to be missing in numbering only as text follows.
13. Two pages numbered __________. Text follows.
14. Curling and wrinkled pages ______
15. Other ____

DIFFERENCES IN MUSIC ACHIEVEMENT AMONG GIFTED AND TALENTED, AVERAGE, AND EDUCABLE MENTALLY HANDICAPPED FIFTH- AND SIXTH-GRADE STUDENTS

by

Donald L. Ellis

A Dissertation submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

Greensboro
1982

Approved by

James W. Sherbon
Dissertation Adviser

ELLIS, DONALD L. Differences in Music Achievement Among Gifted and Talented, Average, and Educable Mentally Handicapped Fifth- and Sixth-Grade Students. (1982)
Directed by: Dr. James W. Sherbon. Pp. 79

The purpose of this study was to identify differences in music achievement among gifted and talented (GT), average, and educable mentally handicapped (EMH) students. A secondary purpose was to determine which selected characteristics--IQ, music aptitude, tonal memory, reading achievement, mathematics achievement, mental age, interest and attitude in music, and sex--can best explain variance in music achievement tests.

Fifth- and sixth-grade students in North Carolina served as subjects for this study. The sample was comprised of 107 GT, 116 average, and 64 EMH students. All students attended one 30-minute music class each week, taught by a music specialist.

The Music Achievement Tests One and Two (MAT 1 and MAT 2) by Colwell, were selected to assess music achievement. The Gaston Test of Musicality (GTM) was used to quantify music aptitude. The subtest "tonal memory" from Seashore Measures of Musical Talent, served as the memory variable. Student interest and attitude were determined by questions 6-16 of the GTM.

Differences in music achievement were analyzed using the General Linear Model of the Statistical Analysis System (SAS) with the MANOVA option. The Scheffé Test provided post hoc analysis. The stepwise regression procedure of SAS, with the maximum R square improvement model, was used to explain variance in music achievement test scores.

Based on the MANOVA analysis, differences in music achievement were found significant, $p = .0001$, for each subtest and total score of

MAT 1 and MAT 2. The post hoc analysis revealed significant differences, $p < .01$, between GT and EMH students. Among all subjects, total test scores and the pitch discrimination subtest were found significant, $p < .01$. Differences between EMH and average students were not significant for all subtests, with the exception of the pitch discrimination subtest, of MAT 1 and MAT 2. Differences between GT and average students were significant, $p < .05$, for interval discrimination, significant beyond $p = .0001$ for all other subtests except tonal center discrimination. In the regression analysis, tonal memory was found to be the best single predictor of MAT 1 and music aptitude was found to be the best single predictor of MAT 2.

Based on the results, it is recommended that music educators design and implement different lessons and objectives for GT students than for average or EMH students. For school administrators, the results of this study imply that average and EMH students can be mainstreamed without adverse educational effects. GT students should not be mainstreamed with either average or EMH students.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of the Graduate School at the University of North Carolina at Greensboro.

Dissertation Adviser James W. Sherbon

Committee Members Walter L. Salinger

Barbara B. Bain

William A. Powers

[illegible]

July 21, 1982
Date of Acceptance by Committee

July 21, 1982
Date of Final Oral Examination

ACKNOWLEDGMENTS

Recognition is due my dissertation adviser, Dr. James W. Sherbon, for his continuous support, guidance, and valuable critique of my research and writing throughout each stage of this dissertation. Appreciation for their assistance and suggestions goes to the other members of my committee: Mrs. Barbara Bair, Dr. Dwight F. Clark, Dr. William A. Powers, III, and Dr. Walter L. Wehner.

Special appreciation for support of this study is due the principals and teachers in each school where student testing occurred.

Special recognition is due my wife, Julie, for her editing, proofreading, and typing; but most of all for her continuous encouragement throughout the preparation of this dissertation.

TABLE OF CONTENTS

Page

CHAPTER

LIST OF TABLES

Page

TABLE

CHAPTER I

INTRODUCTION

The music educator serves a diverse group of learners. Since the passage of Public Law 94-142, the Education for the Handicapped Children Act of 1975, music educators have had both gifted and talented (GT) and educable mentally handicapped (EMH) students, as well as other exceptional students integrated into their classrooms. The inclusion of GT and EMH students into the music class, either mainstreamed or grouped homogeneously, provides music educators the opportunity to consider and interact with the musical potential, musical achievement, personal needs, and problems of a more diverse group of students.

In order to plan instructional strategies for GT, average, and EMH students, music specialists must be aware of differences in music achievement that may exist between students identified as GT, average or EMH. If these differences in music achievement are as significant as differences in academic achievement, the music specialist must be prepared to teach in appropriate ways. The purposes of this study are to identify differences in music achievement among GT, average, and EMH students, and to determine which selected characteristics can best explain results in music achievement tests. Differences in attainment levels of music achievement between GT, average, and EMH students should be identified and distributed to music specialists and classroom teachers. With knowledge of specific characteristics that have greatest influence upon music achievement, music specialists should be better able to focus their instructional efforts on these identified characteristics, with an expected increase in levels of music achievement by students.

Public school students in GT and EMH programs are frequently mainstreamed with average students for classes in art, music, and physical education. It is important for the music specialist to be aware of differences in levels of music achievement between average, GT, and EMH students. One possible negative result of a lack of awareness is that EMH and GT students may become disinterested in music from the mainstreamed experience. GT students may feel restrained by average students, while EMH students may be driven beyond their musical capability, with neither student benefiting educationally from presence in music classes. Knowing these differences may assist teachers and administrators when making an informed decision concerning mainstreaming.

Obvious extramusical differences exist among GT, EMH, and average students, and their effects must be considered before any conclusions can be drawn from music achievement test results. In studies of this kind, test working skills of student groups should be assessed and controlled to ensure that levels of music achievement are not biased by lack of skills in the notation of answers.

In each music class there may be students who engage in musical activities in addition to general music classes. This additional experience (i.e., private music lessons, formal and informal choral and/or instrumental music activities) may positively influence results in music achievement tests. For example, students who are willing to participate in musical activities may also influence music achievement test results due to an apparent positive attitude toward music.

Other considerations for music specialists are the influences of mental age and memory upon music achievement. Mental age may reveal levels of comprehension of student musical experiences. Students who appear to succeed in their music classes are students who are able to retain musical concepts from one lesson to another. This retention or memory ability may be a principal factor that discriminates among student levels of music achievement.

Intelligence and musical experience have been found to be important discriminating factors that help to explain variance in music achievement. Bailey (1975) studied the relationship between scores on music achievement tests, academic achievement, intelligence quotient (IQ), and success in beginning band. He concluded that students with higher IQ test scores were superior in their performance on music achievement tests when compared with students showing low IQ test scores. Further, students who studied piano for more than one year had the highest music achievement test results. Differences between mean scores of band students and nonband students on IQ, academic achievement, and music achievement were significant at or beyond the $p = .05$ level. Swickard (1971) reported that students with instrumental music training scored higher on music achievement tests than did students without an instrumental music background.

Another factor influencing music achievement is sex differences. Swickard (1971) found that girls exceeded boys (grades four, five and six) in music achievement test results by a substantial margin, only if the music class were taught by a music specialist.

Investigating the relationship between music aptitude and intelligence in EMH students, Ianacone (1976) concluded that while EMH students scored considerably lower on music aptitude tests than average students, these test scores for EMH students could have been improved through audio or audiovisual treatment.

Overview of Gifted and Talented and Educable Mentally Handicapped Students

Numerous factors should be considered when referring a child for special educational services: current achievement test scores, reading level, class performance (including work samples), class performance history, and observation of the child in the classroom environment by one or more experienced professionals. Specific criteria for each ability grouping must be met before making a recommendation for placement into special education programs.

Gifted and talented students are those students who "possess demonstrated or potential intellectual, creative or specific academic abilities" (NCSDPI, 1980, p. 1). Students can be nominated for the GT program by teachers, peers, and parents. The stated identification process is accomplished through multiple means, such as

> (a) standardized achievement or aptitude total or subtest scores.
>
> (b) an intellectual assessment score.
>
> (c) superior demonstrated ability in one or more content area(s) as indicated by grades or by demonstrated skills.
>
> (d) recommendations by one or more school personnel (NCSDPI, 1980, pp. 19-20).

GT students are those students who are above average in one or more of the following characteristics: general intelligence, performance in school work, creativity or productive thinking, leadership or communication, reasoning, planning or decision-making, or abstract thinking (NCSDPI, 1980).

Russell (1982) indicates that the guidelines for selection of GT students in North Carolina resulted from a "democratic" information-gathering and decision process. The present guidelines represent seven revisions, the latest enacted into law by the North Carolina State Board of Education.

For acceptance of GT students, Gowan (1979) suggests the use of the following criteria:

> 1. Establishment of an approximate percentage of students for the program . . .
> 2. Use of group test screen and cut point . . .
> 3. Teacher nomination
> 4. Achievement battery and cut-off point
> 5. Formed by the principal, guidance teacher, and other teachers, a list of students with outstanding skills in special areas, leadership qualities, "bright" students. If a student is mentioned on three or more lists, the student should be considered for the GT program (pp. 205-216).

Pegnato and Birch (1959) and Blosser (1963) measured the effectiveness and efficiency of diagnostic test measures as criteria for selecting GT students. While group intelligence tests cannot be relied upon as singular selection tools, the combination of group intelligence tests and achievement tests located 97 percent of the gifted students.

EMH students are those whose IQ range is 50-69 plus or minus one standard error, and in addition, those students who exhibit problems in adaptive and social behavior (NCSDPI, 1980). Based on test results, students are placed into an EMH program at the conclusion of educational and psychological evaluations. Educational evaluation materials often used are IQ tests, past record of academic achievement, and school personnel observation of adaptive and social behavior. Psychological evaluations may include achievement tests, along with personality assessments by a professional school psychologist. Students can be placed into EMH programs only upon the consensus of the parents, teachers, and other professional school personnel (NCSDPI, 1980).

According to Berk, Bridges and Shih (1981), most school administrators have concluded that IQ tests are the "best" diagnostic tool available for placing students into EMH programs. These authors also report that the curriculum at evaluation and placement times is a major cause for student recommendation into EMH classes.

The results of this study can assist music specialists in educating all students to a higher level of music achievement. Music specialists will be able to plan and teach more effectively with knowledge of student differences in music achievement due to intelligence, sex, reading and math levels, memory, mental age, music aptitude, and interest and attitude in music.

CHAPTER II

REVIEW OF LITERATURE

Educators and psychologists have shown concern for investigating differences among individuals for many years. Gagné (1967) has pictured this investigation as one not characterized by a smooth, continuous development. Differences in music achievement have not been examined by many researchers interested in elementary students. In general, comparisons among GT, average, and EMH students have been neglected by both educators and psychologists. This review of the literature is presented to document existing research that has explored variance in student achievement. Specific factors considered are sex, individual learning characteristics, memory, reading ability, musical aptitude and musical achievement.

Sex Differences

For the last twenty years, Gagné (1967) reports, psychologists and educators have investigated sex differences in such areas as intelligence, mathematics, reading and language skills. In comparing general intelligence between males and females, Karnes (1980) found that for GT students IQ test scores were substantially higher for males than females among high school age students. Lao (1980) found differences in academic achievement based on sex. Females with high internal motivation had higher grades than other subjects, including all males. The results of the study "indicate some factors that influence achievement operate differently for males and females" (p. 119). Hall (1978) argues that sex differences in general intelligence are meaningful and that girls are more susceptible to score changes on IQ tests than are boys. Sex differences were also considered when comparing the relationship of IQ to grade point average (GPA). Hall contends that while boys' IQ and GPA were related, girls' IQ and GPA were not related. In a study involving public school students, Leinhardt et al. (1979) reached the opposite conclusion: "no consistent sex differences have been found for general intelligence" (p. 433).

Studies that focus on specific abilities present a different picture from those directed at general intelligence. Sex differences in mathematics, according to Hashway (1981), have generated considerable research in the last two decades. Researchers generally conclude that males and females differ in mathematical abilities. Maccoby (1966) points to the conflict among researchers stating that "during grade school years, some studies show boys beginning to forge ahead on tests of 'arithmetic reasoning,' although a number of studies show no sex differences on this dimension at this time" (p. 26).

In a 1961 study, Gates concluded that boys score higher than girls on tests of mathematical ability. This conclusion was confirmed and reestablished by Stanley (1980) and Aiden (1973). Stanley, a long time researcher of sex differences in mathematics, contends that boys do better on the mathematics section of the SAT than do girls. According to Marshall (1981) boys were superior to girls in answering story problems correctly, as boys' responses depended upon results of the associated computation. Boys were more dependent upon the computations to solve story problems, while girls did not depend on computations as a means for solution to the story problems. In a longitudinal study, Hilton and Berglund (1974) discovered that at the grade five level there were no sex differences in mathematics achievement. According to the same authors and Gates (1961), sex differences in mathematics achievement emerge during adolescence and dramatically increase after adolescence. Hilton and Berglund (1974), along with Benbow (1980), found that sex differences in mathematics achievement may be due to differences in interest in mathematics and science brought about through socialization. Benbow adds that socialization is an important factor in women's mathematic achievement, though not the only factor.

The arguments for significant sex differences in mathematics are many, as are the believers that what differences there may be are attributable to other characteristics. Hall (1978) concluded that SAT mathematic test scores for girls were not substantially different from boys. Hashway (1981) surveyed college freshman entrance examinations and concluded that:

> Males and females did not differ on whole number arithmetic, decimals, integer arithmetic, graphs and tables, and elementary algebra. Females showed a significantly higher ability to deal with problems involving fractions than did males. Males were more proficient than females at solving problems involving elementary geometric principles, ratio, proportion or percent (p. 139).

The argument against unique sex differences in mathematics is best stated by Hashway (1981):

> About 98 percent of the differences between mathematical achievement can apparently be attributed to some characteristic other than sex (p. 139).

Differences Among Learning Characteristics

Individual differences in learning are reliable and predictable across groups as well as within groups (DeBoth & Dominowski, 1978). This section will review literature comparing GT, average, and EMH students on styles and characteristics of learning.

Heal, Ross, and Sanders (1966) suggest that a retarded person's cognitive functioning is impaired by two factors: an inability to suppress previously acquired habits, and a susceptibility to disruption by new stimuli. The last suggested factor is described by the researchers as a major difference between EMH students and normal students. One reason offered by Smith (1971) as to why EMH students are easily distracted is that these particular students frequently fail to perceive similarities and differences in surrounding stimuli. Because of this implied perception problem, EMH students, when compared to average students, are unable to isolate and concentrate on relevant stimuli. In an observational study of retarded and average students' behavior, Krupski (1979) determined that EMH students were less attentive than average students during periods of academic work. EMH students were observed to spend less time on assigned work, more time out of their chairs, and more time "looking busy" but not working.

When EMH students are matched with average students by mental age (MA), EMH students retain problems in control of attention and ease of distraction. Smith, Kaufman, and Dutch (1975) matched EMH students with sixth-grade average students of the same chronological age (CA) and MA matched with average first graders. Both average student groups outperformed the EMH students, leading the researchers to conclude that

EMH students are less able to focus their attention on the process of identification of stimuli than average students. In a similar study involving differences in discrimination and transfer learning, EMH students were slower to learn than either the CA or MA matched average students (Richmond, 1978). Richmond decided that the slower learning rate for EMH students "is due to the greater frequency of control by dominant dimensions and the initial control by novel stimuli" (p. 268). Zeaman and House (1963) agree that the poor discrimination performance by EMH students is a result of the failure to attend to the relevant stimuli. However, once the relevant stimulus is focused on by EMH students, the process of acquiring learning is the same for all students.

Few studies compare the differences between GT and non-GT students. These students are thought to have different styles of learning. Alvino (1981) observed that GT students preferred visual learning, independent, self-directed activities without teacher motivation or assistance. Average and EMH students preferred auditory learning, group activity, teacher motivation, and were less persistent toward task completion. Ward (1979) studied differences in sixth graders' ability levels in higher cognitive processes. He concluded that GT students showed a greater ability in thinking skills related to analysis, synthesis, and evaluation than did non-GT students. Students with high verbal ability were able to determine more matches than low verbal students. However, low verbal students were equal to the high verbal students on physical matching (Hunt, Lunneborg, & Lewis, 1975). These authors suggest that students can be classified as either auditory or visual learners. However, DeBoth and Dominowski (1978) recommended that students could not be categorized as auditory or visual learners.

When comparing EMH and average students, subjects are usually matched by mental age (MA). Morelan (1976) concluded that MA is the best predictor for the rate of processing information. Low MA subjects became increasingly inferior in performance when the complexity of information was increased, as compared to older subjects, regardless of intelligence. Average students, when matched with EMH students, "were generally better at the Piagetian tasks of conservation, quantitative concepts, and conception of the world and physical causality" (Weisz & Yeates, 1981, p. 153). Brown (1973) compared GT, average, and EMH students' abilities in number conservation and continuous quantity. He concluded that EMH students performed like average students of the same MA, but not as well as average students of the same chronological age (CA). GT students performed more like their average CA peers, but not as efficiently as average students of the same MA. Brown determined the MA of his subjects on the basis of the Stanford-Binet Intelligence Quotient Test (3rd. rev. ed.).

One important study for clarifying differences between EMH and average students was conducted by Nidiffer and Fowler (1981). They compared average and EMH student performance on a manual control task, with and without visual feedback. The authors concluded that the ability to discriminate internal cues appears to be related to IQ. EMH students need external cues, verbal and visual stimulation, and additional time for practice when compared to average students of the same MA.

Memory Differences

Unlike research into individual differences, memory differences have been a subject of continuous research in psychology for many years (Royer, 1978). Early research by Gillete (1936) led to the conclusion that fast learners were superior in memory retention to slow learners. Years later this conclusion was challenged by Underwood (1954), Gregory and Bunch (1959), and Shuell and Keppel (1970). More recent researchers have decided that fast and slow learners do not differ in retentive memory ability. Both groups of learners retain information equally well when they begin at the same stage of learning.

A comparison of average students with mentally retarded students revealed a difference in strategy between the two groups. Average students devised and rehearsed a strategy to aid memory retention while mentally retarded students developed no method or means to assist with memory retention (Brown, Campione, & Murphy, 1974). In a unique study involving GT, average, and poor readers, Feibel (1979) compared memory for sentences and found that all groups performed similarly on experienced sentences. After word changes were made, GT students outperformed the other groups at a consistent rate. Feibel suggests that poor readers do not have a general memory deficiency, but are deficient in comparing experienced sentences with manipulated sentences.

Research by other authors including Ford and Keating (1981), Goldberg, Swartz, and Stewart (1977) apparently contradicts the conclusions reached by Feibel. Verbal ability is highly related to memory retrieval speed (Ford & Keating, 1981). Differences in verbal ability are dependent upon retrieval speed in long-term memory. High verbal ability is related to high retrieval speed while low verbal ability is related to low retrieval speed (Goldberg, Swartz, & Stewart, 1977).

Memory differences between fast and slow learners are minimal when the degree of knowledge is taken into account (Shuell & Keppel, 1970). The same authors, while agreeing that substantial individual differences in the rate of learning exist, conclude that individual differences in retention appear to be unimportant. Differences in learning rates could be partially responsible for basic capacities in short-term memory (Hunt, 1977; Hunt, Frost, & Lunneborg, 1973). A contrasting theory involving memory differences is offered by Roger, Hambleton, and Cadorette (1978). Roger and associates believe ". . . that retention between individuals should vary when the learning materials are meaningful and when one individual has a 'richer' prior knowledge" (Roger et al., 1978, p. 189). They also suggest that differences in memory are the result "of each learner's current arrangement of knowledge" (p. 187). This structure of knowledge has direct bearing on what information is processed and stored in memory or discarded.

Differences in memory ability may be more than individual ability differences, structure of knowledge, or their combination. Memory ability may show differences when students exhibit physical fatigue. Comprehension problems in reading or listening may be caused by a memory system that is overworked (Daneman & Carpenter, 1980).

Memory differences between GT, average, and EMH students may be influenced by attentional problems often observed in EMH students. Research conclusions by Crosby and Blatt (1968), Denny (1966), and Goldstein (1943) indicate that mentally retarded individuals are unable to focus their attention on relevant stimuli for a continuous rate. These same students are often distracted by off-task stimuli. EMH students display similar attention-control problems. When compared to average children, Krupski (1979) found that EMH students were less attentive during academic work periods.

Bruscia (1981) points to a lack of research involving nonverbal or auditory stimuli as a principal source of stimulation. Visual stimulation and performance have been the focus of research concerning attentional control processes (Brown, 1966; Sen & Clark, 1968; Hagen & Huntsman, 1971). Bruscia studied short-term memory and attentional control using musical rhythm as the nonverbal stimuli. Based on results of the study, he concluded that retarded individuals with higher IQ test scores were generally superior in auditory memory, when compared to those with low IQ test scores. The researcher discovered that when irrelevant stimuli were introduced into the study, memory ability and attention control declined for all subjects, regardless of IQ. Bruscia suggests "that attentional control does not vary among retarded individuals according to intelligence parameters" (p. 437).

Memory differences, as cited in the literature, can be accounted for by IQ, verbal ability, basic knowledge, knowledge structure, retention strategies, mental fatigue, or a lack of attentional control. While there is no apparent central belief concerning the reason for memory differences, all researchers are in agreement concerning the existence of differences in memory.

Reading Ability Differences

Researchers in the study of differences in reading achievement traditionally have used the categories "good" and "poor" readers to identify group differences. For the purpose of this study, EMH students will be considered as poor readers, while in general, GT and average students will be considered good readers.

In a study by Koral (1979), the researcher identified characteristic differences between good and poor readers. Good readers were able to recognize all visually presented stimuli and pick out relevant stimuli while ignoring irrelevant stimuli. Poor readers were not proficient at the two tasks mentioned above but were equal with good readers in delayed recall. In a similar study involving reading comprehension, Weisberg (1978) believes that poor readers are deficient in general language ability. Poor readers were characterized as unable to use prior knowledge effectively in formulating complete and specific coded answers to questions concerning the comprehension level of a short story. Weisberg determined that good readers recall more main ideas than poor readers, recall more clearly stated and inferred information, and answer more questions correctly than poor readers.

In a study by Taylor (1978), good third-grade readers were matched with poor fifth-grade readers. Although no differences were found, third graders were able to recall more main ideas from previously read stories than fifth graders. Poor readers were also found to exhibit problems in identifying main ideas. With increased difficulty of written passages, differences in reading comprehension increased, favoring the third graders. The poor readers appear to comprehend on their reading level similarly to the good third-grade readers. Bos (1979), Mosley (1978), and Smisek (1980) have concluded that poor readers have difficulty formulating logical inferences about what is read. As the intelligence level increases so does the performance on inferential questions.

In a unique study, Hagen (1979) examined average, GT, and high GT on their ability to form concepts and principles after reading. The ability to synthesize a principle from a written passage is related to mental age, while chronological age is strongly related with task performance speed once the task has been learned.

Jamieson (1979) examined preferences of GT and average students on normal or time-compressed speech versions of literary selections. GT students preferred time-compressed versions of literary selections, while average students preferred normal speech. Average students performed poorly on comprehensive questions about the reading when compared to GT students.

Cummins and Das (1980) offered an explanation of poor reading performance of EMH students:

> Poor reading skills of many EMH students may not be entirely attributable to their low intellectual ability in itself. EMH children's failure to effectively apply their intellectual abilities to literacy-related academic tasks, may also contribute significantly (p. 179).

Musical Differences

Student differences in music achievement or aptitude in music are seemingly an area of little interest for researchers in music education or psychology. This section will present literature concerned with the use of the Seashore Measures of Musical Talent (SMMT), differences in music achievement between EMH and average students, and significant contributory factors affecting music achievement.

Deceuir and Braswell (1978) attempted to discriminate learning-disabled children from average children using the SMMT. The researchers discovered that test examples were presented too quickly for student perception. They concluded that this problem was a principal cause for below-average test results.

Though the SMMT may have historical value, Dimond (1974) argued that the SMMT should not be used as a predictive instrument indicating probable success in college music programs. The researcher concluded that the SMMT did not discriminate between music interest level groups, though the subtest "tonal memory" is related to applied music grades.

Using the Gaston Test of Musicality (GTM), Wermuth (1971) investigated the relationship between music aptitude, family and student activity in music, student interest in music, socioeconomic status (SES), and intelligence among white and black students, grades six through eight. Wermuth concluded that all of the variables named above, except SES, were found to be related significantly at or beyond the $p = .01$ level for all white students, and at or beyond the $p = .05$ level for some grades of black students. Questions 8-17 of the GTM were used to assess student interest.

Ianacone (1976) examined the relationship between music aptitude and intelligence for EMH students. The Music Aptitude Profile (MAP) by Gordon was used to quantify music aptitude. Ianacone determined that only a minimal relationship exists between intelligence and music aptitude. Normal students and mental age EMH students were found to have higher MAP test scores than EMH students not related to mental age. Ross, Ross, and Kuchenbecker (1973) determined that EMH students lack rhythmic ability when compared to average students. Rhythmic ability, they contend, is an important component of the lack of ability that EMH students exhibit on gross and fine motor skills. However, when Kaplan (1977) matched EMH and average students with MA, he found that rhythmic skills were very similar, except in echo tapping where average students were superior. The EMH students were limited only by a deficiency in memory.

In a related study, Peters (1970) studied differences in music sensitivity between EMH and average students. The researcher found that little difference in music sensitivity existed between groups of younger students, but differences favoring average students increased in magnitude with advancing student age.

Bailey (1975) concluded that students with higher IQ test scores also scored higher on the Music Achievement Test One and Two (MAT 1 and MAT 2) by Colwell. Bailey also concluded that students with one or more years of piano study, high IQ, and a history of participation in the instrumental music program had higher MAT test scores than any other identified students. Swickard (1971) concurred with Bailey, citing that students with instrumental music training had higher MAT test scores than those without such training. Swickard also concluded that the music specialist teaching the music class makes a substantial difference in MAT test scores in favor of girls.

The MAT was used by McCarthy (1980) to investigate the effects of individualized instruction on music achievement in elementary instrumental music students. The researcher concluded that reading level and SES are related to music achievement. Neither grade level nor sex was found to be related to MAT test scores. Jarrell (1971) found aural discrimination achievement strongly related to the following variables: sex, private music study, and sight-reading practice emphasized in high school band classes.

Very few studies illustrate differences in music achievement among GT, average, and EMH students. Several studies are presented to justify this researcher's choice of test instruments for this study. The literature does present common variables that are important in assessing variance in music achievement: sex, interest in music, activity in music, intelligence, and reading level. Using these common variables, this study explores an approach to understanding variance in music achievement. This study is unique, when compared to existing literature, by contrasting differences in music achievement among three different ability groups commonly encountered in public schools: GT, average, and EMH students.

The primary objective in this study is to determine whether differences in music achievement exist for GT, average, and EMH students. Is this difference as evident as the differences in reading, memory, and/or sex? Do variables frequently used in music achievement research studies form a significant prediction model for achievement in music?

The null hypotheses are:

1. In the multivariate analyses, there will be no significant difference in music achievement test scores among GT, average, and EMH fifth- and sixth-grade students.

2. No regression model will be obtained that explains 20 percent of the statistical variance in music achievement.

The alpha level for this study is set at $p = .05$.

CHAPTER III

METHOD

Students in fifth and sixth grades in urban and rural school settings have served as subjects for this study. Intact classes of GT, average, and EMH students were utilized resulting in sample sizes of 107 GT, 116 average, and 64 EMH students. All students attended music classes one time per week (30 minutes) taught by a music specialist.

Test Description

Music Achievement Tests 1 and 2 (MAT 1, MAT 2) by Colwell were used to assess musical achievement--the dependent variable. MAT 1 includes areas of "pitch discrimination," "interval discrimination," and "meter discrimination" (Colwell, 1970). MAT covers "auditory-visual discrimination," "feeling for tonal center," and "major-minor mode discrimination" (Colwell, 1970). The stated purposes of the tests are to determine

> (a) the extent to which the student has profited from past instruction,
>
> (b) the quality of instruction, and
>
> (c) the extent to which students will likely profit from future instruction (Colwell, 1970, p. 148).

Colwell correlated teacher ratings of student ability with MAT scores establishing a criteria-related validity of $\underline{r}$ = .92 (Colwell, 1970). "Reliability of MAT 1 is $\underline{r}$ = .94 computed by split-half, and $\underline{r}$ = .88 computed by KR-21" (Colwell, 1970, p. 149). Reliability of MAT 2 is judged higher overall with a "*r* = .942 computed by split-half, *r* = .935 by KR-21" (Colwell, 1970, p. 149). MAT 1 and MAT 2 were standardized using "at least 9,000 students for each test, divided by geographic area, type of teacher, size of community, and grade level" (Colwell, 1970, p. 149).

The Gaston Test of Musicality (GTM) was used to quantify "innate musical sensitivity of the individual" (Gaston, 1957, p. 1). The purpose of the GTM is to determine a student's "awareness of tonal-rhythmic configurations and his response thereto" (Colwell, 1970, p. 164). Criterion-related validity was established by means of correlation of test scores and teacher ratings of student ability. Validity "for grades four through nine is *r* = .88, and *r* = .90 for grades ten through twelve" (Colwell, 1970, p. 165). The norming sample numbered "4840 from 26 schools in seven states . . ." (p. 164).

The subtest "tonal memory" from Seashore Measures of Musical Talent (SMMT) (Seashore, Lewis, & Saetveit, 1960) served as the memory variable. In the "tonal memory" subtest students determine which note in a pattern has been altered. For determining a relationship with music achievement, memory was evaluated using musical patterns and pitches, not words or digits.

Procedure

Notational skills were assessed using a stratified sample of students randomly selected from each student group (GT, average, and EMH). For this testing procedure students did not hear test questions, but were told "answers" by the test administrator and directed to fill in corresponding answer blanks. For example, using a facsimile of MAT 1 students are given the following directions.

> Students, the answer for question one is "2," fill in answer blank "2" for question number one. The answer for question two is "S," fill in answer blank "S" for question two. The answer for question three is "1," fill in answer blank "1" for question three.

Assessment results have been correlated to determine strength of relationship between student groups. If r = .85 or higher, student notating skills were judged to be equal. See Appendix A for test form assessing notational skills.

Using existing data in student records, the researcher recorded student IQ scores, mental ages, reading levels, mathematics levels, and sex. Student IQ and mental age data were quantified by the Short Form Test of Academic Aptitude (SFTAA) (Sullivan, Clark, & Tiegs, 1970). Reading and mathematics levels were assessed by the Comprehensive Tests of Basic Skills (CTBS). The SFTAA and CTBS, at the time of the study, were routinely administered through the auspices of the North Carolina Annual Testing Program. The SFTAA consists of "four separately timed subtests: Vocabulary, Analogies, Sequences and Memory. Vocabulary and Memory constitute the Language Section" (Sullivan et al., 1970, p. 5). The CTBS is a battery of "seven tests in three basic skill areas: Reading, Language, and Mathematics" (CTBS, Handbook, 1976, p. 1).

Music tests were administered by the researcher with four test sessions scheduled on four separate days. The MAT 1 was administered first, with each succeeding test scheduled no less than 48 hours following any other testing procedure. MAT 2 was administered second, followed by the GTM, and the SMMT tonal memory subtest. Questions 6-16 of the GTM have been used to assess student interest and attitude in music. The researcher read orally all test directions, working of examples, and survey questions. Testing occurred at approximately the same time of day for all subjects. The test schedule was devised to minimize fatigue, boredom, and bias in testing time. The researcher administered all tests following standardized procedures stated by the test authors.

Data were analyzed using the Statistical Analysis System (SAS), and are treated descriptively using the univariate procedure. The MAT 1 and MAT 2 subtests and total scores for GT, average, and EMH students have been analyzed for differences using the General Linear Models multivariate procedure. With each music achievement test providing three subtests and a total score, analysis resulted in an 8 x 3 design. In an exploratory approach to explaining variance in music achievement, this study used the stepwise regression procedure with the maximum R^2 improvement model option. "This method does not settle on a single model. Instead it looks for the 'best' one-variable model, the 'best' two-variable model, and so forth" (SAS, 1979, p. 391). A post hoc analysis using the Scheffé Test was performed to determine what specific differences in music achievement exist among all subject groups.

Results of the analyses are displayed in table form with explanatory paragraphs. The descriptive analysis results are presented first, followed by the multivariate, post hoc, and stepwise regression analyses.

CHAPTER IV

RESULTS

A comparison of notational skills among subjects resulted in the following correlations: r = .99 between gifted and talented (GT) and average subjects; r = .91 between average subjects and educable mentally handicapped (EMH); and with the identical relationship r = .91 between GT and EMH subjects. All correlations exceeded the strength of relationship (r = .85), which was the criterion established to assume equality among subjects in notational skills.

Descriptive Sample Data

Descriptive data generated by the univariate procedure of the Statistical Analysis System (SAS) are presented in Table 1 for variables MAT 1 total score, MAT 2 total score and IQ.

Table 1

Descriptive Data for MAT 1, MAT 2, and IQ for Total Sample

Measure	N	Mean	Median	SD	Kurtosis	Skewness
MAT 1	287	43.51	43	11.02	-0.29	0.22
MAT 2	287	40.19	38	13.24	1.77	1.18
IQ	282[a]	102.08	107	24.40	-0.95	-0.40

[a]Five incomplete student files

Additional descriptive data are placed in the appendices (see Appendix B).

Table 2 presents descriptive results by student group.

Table 2

Descriptive Data by Student Group

Educable Mentally Handicapped Students

Measure	N	Mean	Median	SD	Kurtosis	Skewness
MAT 1	64	33.89	34	7.10	-0.51	-0.10
MAT 2	64	31.14	32	6.41	-0.08	-0.12
IQ	64	66.89	68	8.09	0.37	-0.53

Average Students

Measure	N	Mean	Median	SD	Kurtosis	Skewness
MAT 1	116	42.34	41	9.88	0.22	0.45
MAT 2	116	37.81	36.5	10.78	0.92	0.95
IQ	111	101.08	103	14.39	0.60	-0.17

Gifted and Talented Students

Measure	N	Mean	Median	SD	Kurtosis	Skewness
MAT 1	107	50.53	51	9.21	0.20	-0.01
MAT 2	106	48.26	45.5	14.21	0.86	0.98
IQ	107	124.16	125	9.25	0.19	0.00

For each selected variable, the mean and median are approximately equal while the kurtosis and skewness lie between ± 1.0. These measures appear to be consistent with a normal distribution. (See Appendix C for descriptive analysis by group.) Table 3 presents mean scores for each variable used in the study.

Table 3

Means of Variables Used in This Study

Variable	EMH	Average	GT
Pitch Discrimination	7.94	14.53	18.24
Interval Discrimination	12.08	13.16	14.53
Meter Discrimination	13.70	14.66	17.84
Major-Minor Discrimination	11.83	13.37	16.50
Tonal Center Discrimination	5.22	7.22	8.83
Auditory-Visual Discrimination	14.25	17.15	23.13
MAT 1 Total Score	33.89	42.34	50.53
MAT 2 Total Score	31.14	37.81	48.26
Music Aptitude	22.80	28.08	35.83
Tonal Memory	8.89	16.78	24.45
Interest in Music	5.72	5.97	7.05
Reading Achievement	295.78	424.13	495.61
IQ	66.89	101.08	124.16
Mathematics Achievement	283.77	402.08	453.42
Mental Age	7.83	12.04	14.43

Multivariate Analysis

Differences among EMH, average, and GT students in selected abilities in music achievement were analyzed through the General Linear Model (GLM) procedure of SAS, with the "Manova" option. Tables 4 through 11 present the analysis of variance for each music achievement subtest and total test score by school group (EMH, average, and GT). Each subtest and total score was found to be significant at the

p = .0001 level. Pitch discrimination received the largest F value, F (2,283) = 95.30, while interval discrimination had the lowest F value, F (2,283) = 10.96. For this study, pitch discrimination shows the greatest difference among subjects, while interval discrimination differs the least among student groups.

Table 4

MANOVA: MAT 1

Dependent Variable: Pitch Discrimination

Source	df	Sum of Squares	Mean Square	F	p
Model	2	4203.80	2101.90	95.30	0.0001
Error	283	6241.51	22.05		
Corrected Total	285	10445.31			

Table 5

MANOVA: MAT 1

Dependent Variable: Interval Discrimination

Source	df	Sum of Squares	Mean Square	F	p
Model	2	255.79	127.90	10.96	0.0001
Error	283	3302.17	11.67		
Corrected Total	285	3557.96			

Table 6

MANOVA: MAT 1

Dependent Variable: Meter Discrimination

Source	*df*	Sum of Squares	Mean Square	*F*	*p*
Model	2	856.53	428.27	17.98	0.0001
Error	283	6741.16	23.82		
Corrected Total	285	7597.69			

Table 7

MANOVA: MAT 1

Dependent Variable: MAT 1 Total Score

Source	*df*	Sum of Squares	Mean Square	*F*	*p*
Model	2	11216.29	5608.15	67.95	0.0001
Error	283	23356.86	82.53		
Corrected Total	285	34573.15			

Table 8

MANOVA: MAT 2

Dependent Variable: Major-Minor Discrimination

Source	*df*	Sum of Squares	Mean Square	*F*	*p*
Model	2	1000.51	500.25	31.08	0.0001
Error	283	4554.67	16.09		
Corrected Total	285	5555.18			

Table 9

MANOVA: MAT 2

Dependent Variable: Tonal Center Discrimination

Source	*df*	Sum of Squares	Mean Square	*F*	*p*
Model	2	835.47	417.74	12.04	0.0001
Error	283	9820.20	34.70		
Corrected Total	285	10655.68			

Table 10

MANOVA: MAT 2

Dependent Variable: Auditory-Visual Discrimination

Source	df	Sum of Squares	Mean Square	F	p
Model	2	3629.40	1814.70	27.19	0.0001
Error	283	18884.66	66.73		
Corrected Total	285	22514.06			

Table 11

MANOVA: MAT 2

Dependent Variable: MAT 2 Total Score

Source	df	Sum of Squares	Mean Square	F	p
Model	2	12808.26	6404.13	48.75	0.0001
Error	283	37174.17	131.36		
Corrected Total	285	49982.42			

Through the Manova option, the Wilk's Criterion was generated to assess differences among multiple dependent variables. The multivariate analysis of Wilk's Criterion resulted in F (16,552) = 13.66, p = .0001, with the U statistic = 0.51307.

Table 12

Scheffé Test: Differences in Music

Achievement Among Subject Groups

Variable	EMH/AVE	EMH/GT	AVE/GT
Pitch Discrimination	40.21**	98.23**	17.42**
Interval Discrimination	2.04	10.46**	4.47+
Meter Discrimination	0.79	14.65**	11.76**
Major-Minor Discrimination	3.00	27.61**	16.89**
Tonal Center Discrimination	2.34	7.69**	2.07
Auditory-Visual Discrimination	2.56	24.04**	14.90**
MAT 1 Total Score	17.59**	68.20**	22.59**
MAT 2 Total Score	6.89*	45.37**	23.09**

+$p < .05$
*$p < .01$
**$p < .001$

The Scheffé Test (Table 12) was used to assess specific differences in music achievement among GT, average, and EMH subject. All differences between EMH and GT subjects are significant, $p < .001$. A comparison of differences between average and GT subjects resulted in a nonsignificant difference in total center discrimination, while interval discrimination was found to be significant, $p < .05$, with all remaining variables significant beyond $p < .001$. In the comparison of EMH and average subject subtest scores, only pitch discrimination was found significant, $p < .001$. All other subtests resulted in no significant differences.

Through the use of the standard procedure of SAS, test results were standardized with a mean of 100, and a standard deviation of 10. The standardized discriminant function coefficients for the multivariate analysis are reported in Table 13, showing the strength of association each variable can discriminate among subjects.

Table 13

Standardized Discriminant Function Coefficients for Music Achievement Tests

Variable	Standardized Coefficient
Pitch Discrimination	1.1919
Interval Discrimination	0.4512
Meter Discrimination	0.4770
MAT 1 Total Score	-1.0546
Major-Minor Discrimination	-0.0793
Tonal Center Discrimination	-0.0122
Auditory-Visual Discrimination	-0.4291
MAT 2 Total Score	0.6399

Exploratory Regression Analysis

A correlation matrix shows positive correlations among all variables, with the strength of relationship ranging from r = .08 to r = .96 (see Appendix D). The regression analysis used the stepwise procedure of SAS with the maximum R-square option. Table 14 presents the best one variable model for predicting total scores on MAT 1. This model explains approximately 44 percent of the variance in total test scores of MAT 1, accounting for 44 percent of the total variability of these scores.

Table 14

Stepwise Regression: Best One

Variable Model for MAT 1

R Square = 0.44					
Variable	df	Sum of Squares	Mean Square	F	p
Tonal Memory	1	13356.17	13356.17	200.88	0.0001
Error	251	16688.83	66.49		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	26.80				
Tonal Memory	0.94	0.07	13356.17	200.88	0.0001

Table 15 shows the best two variable model for MAT 1. This model takes into account variables tonal memory and music aptitude. Together both variables explain approximately 52 percent of the variance in total test scores of MAT 1. With the addition of music aptitude, eight percent more of the variability of MAT 1 test scores can be described (see Table 15).

The best three variable model for MAT 1 is shown in Table 16. The variables tonal memory, music aptitude, and interest explain approximately 53 percent of the variance in MAT 1.

Table 15

Stepwise Regression: Best Two

Variable Model for MAT 1

R Square = 0.52					
Variable	df	Sum of Squares	Mean Square	F	p
Music Aptitude	2	15511.01	7755.50	133.40	0.0001
Error	250	14533.99	58.14		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	19.49				
Music Aptitude	0.44	0.07	2154.84	37.07	0.0001
Tonal Memory	0.61	0.08	3192.49	54.91	0.0001

Table 16

Stepwise Regression: Best Three

Variable Model for MAT 1

R Square = 0.53					
Variable	df	Sum of Squares	Mean Square	F	p
Interest in Music	3	15800.91	5266.97	92.07	0.0001
Error	249	14244.09	57.21		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	17.79				
Music Aptitude	0.42	0.07	1887.33	32.99	0.0001
Tonal Memory	0.58	0.08	2875.16	50.26	0.0001
Interest in Music	0.45	0.20	289.90	5.07	0.0252

All other variables--IQ, reading achievement, mathematics achievement, sex, and mental age--in conjunction with tonal memory, music aptitude, and interest explain approximately 54 percent of the variance of MAT 1. Table 17 is the regression model using all eight independent variables. Other models using four, five, six and seven variables appear in the appendices (see Appendix E).

Table 17

Stepwise Regression: Best Eight

Variable Model for MAT 1

R Square = 0.54					
Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
Mathematics Level	8	16094.86	2011.86	35.19	0.0001
Error	244	13950.14	57.17		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	*F*	*p*
Intercept	13.81				
IQ	0.02	0.09	2.43	0.04	0.84
Reading Level	0.01	0.02	36.17	0.63	0.43
Mathematics Level	-0.00	0.02	0.41	0.01	0.93
Music Aptitude	0.38	0.08	1455.20	25.45	0.0001
Tonal Memory	0.42	0.11	853.92	14.94	0.0001
Interest in Music	0.48	0.21	318.03	5.56	0.02
Sex	-0.49	0.99	13.94	0.24	0.62
Mental Age	0.09	0.64	1.25	0.02	0.88

In Table 18 the regression model for MAT 2 differs slightly from the model for MAT 1. For MAT 2, music aptitude is the best single predictor, able to explain 41 percent of the variability of MAT 2 total test scores. Differences in MAT 2 test scores can best be accounted for by music aptitude test scores.

Table 18

Stepwise Regression: Best One

Variable Model for MAT 2

R Square = 0.41					
Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
Music Aptitude	1	17196.64	17196.64	175.45	0.0001
Error	250	24504.32	98.02		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	*F*	*p*
Intercept	11.42				
Music Aptitude	0.95	0.07	17196.64	175.45	0.0001

The best two variable model contains music aptitude and tonal memory; together they explain 48 percent of the variance in MAT 2 total scores (Table 19). The inclusion of the variable interest into the previous regression equation, Table 18, allows the explanation of 53 percent of the variance in MAT 2 total test scores.

Table 19

Stepwise Regression: Best Two

Variable Model for MAT 2

R Square = 0.48					
Variable	df	Sum of Squares	Mean Square	F	p
Tonal Memory	2	20207.41	10103.70	117.05	0.0001
Error	249	21493.56	86.32		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	11.25				
Music Aptitude	0.60	0.09	3982.61	46.14	0.0001
Tonal Memory	0.59	0.10	3010.76	34.88	0.0001

Table 20

Stepwise Regression: Best Three

Variable Model for MAT 2

R Square = 0.53					
Variable	df	Sum of Squares	Mean Square	F	p
Interest in Music	3	22097.64	7365.88	93.19	0.0001
Error	248	19603.33	79.05		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	6.89				
Music Aptitude	0.55	0.09	3168.42	40.08	0.0001
Tonal Memory	0.53	0.10	2338.40	29.58	0.0001
Interest in Music	1.16	0.24	1890.23	23.91	0.0001

The best three variable model for MAT 2 is shown in Table 20. The variables music aptitude, tonal memory, and interest explain approximately 53 percent of the variance in MAT 2.

Table 21 presents the effect each variable has on MAT 2. Only music aptitude, tonal memory, and interest are significant (p = .0001) predictors of MAT 2 total test scores. See Appendix F for other regression models.

Table 21

Stepwise Regression: Best Eight

Variable Model for MAT 2

R Square = 0.54

Variable	df	Sum of Squares	Mean Square	F	p
Sex	8	22524.19	2815.52	35.68	0.0001
Error	243	19176.77	78.92		
Total	251	41700.96			

	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	10.17				
IQ	0.23	0.10	376.45	4.77	0.03
Reading Level	-0.02	0.02	42.80	0.54	0.46
Mathematics Level	-0.01	0.02	28.97	0.37	0.54
Music Aptitude	0.55	0.09	3017.85	38.24	0.0001
Tonal Memory	0.57	0.13	1535.63	19.46	0.0001
Interest in Music	1.09	0.24	1582.21	20.05	0.0001
Sex	0.35	1.17	7.08	0.09	0.76
Mental Age	-1.34	0.76	248.14	3.14	0.08

For both regression equations, for MAT 1 and MAT 2, the variables tonal memory, music aptitude, and interest are the three best predictors. The amount each regression model could explain variability in either MAT 1 and MAT 2 was approximately the same, 54 percent.

Summary

Differences in music achievement among GT, average, and EMH fifth- and sixth-grade students are shown by the multivariate analysis to be significant for each subtest and total score of MAT 1 and MAT 2. In post hoc analysis, the Scheffe Test reveals significant differences among all groups for MAT 1 and MAT 2 total test scores. Differences in subtest scores were found significant between GT and EMH subjects and between GT and average subjects. Pitch discrimination was the only subtest to show significant differences among all subject groups. In the stepwise regression analysis both regression models explain more than 20 percent of the variance in music achievement. The alpha level of $\underline{p} = .05$ was exceeded by the multivariate and stepwise analyses.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purposes of this study were to identify differences in music achievement among GT, average, and EMH students and to determine the relationship between music achievement and a selected set of predictor variables--music aptitude, IQ, reading achievement, mathematics achievement, tonal memory, interest in music, mental age, and sex. Significant differences in music achievement among GT, average, and EMH subjects were found for total test scores of MAT 1 and MAT 2. These differences can provide a basis for specifically designed objectives and goals for each student group.

Hypotheses

From the results of the analyses, the null hypotheses for this study were rejected.

1. In the multivariate analysis there will be no significant ($p < .05$) differences in music achievement test scores among gifted and talented, average, and educable mentally handicapped fifth- and sixth-grade students (see Tables 4-11, pp. 29-32).

2. No regression model will be obtained that explains 20 percent of the statistical variance in music achievement (see Tables 14-21, pp. 35-40).

Further, the post hoc analysis (Scheffé Test) revealed a clustering effect in the multivariate analysis. EMH and average students' ability in each of the following subtests--interval, meter, major-minor, tonal center, and auditory-visual discrimination, within limits of this analysis, were judged to be equal. GT students, however, were shown to be widely separated in music achievement from EMH and average students. For each subtest, except tonal center discrimination, GT students were found to be significantly higher in music achievement than the two other student groups. Total test scores for MAT 1 and MAT 2 and the pitch discrimination subtest show significant differences among all student groups.

The results of this study have been derived from an assessment of music achievement levels in fifth- and sixth-grade students, attending a weekly 30-minute music class taught by a music education specialist. A generalized application of the study is limited by the following:

1. The narrow age range of the subjects
2. The socioeconomic characteristics of a semiurban southern country
3. The selection criteria used for GT and EMH programs.

The results of this study are important to both elementary music teachers and school administrators. Music teachers can plan more effectively knowing specific levels of music achievement characteristic of GT, average, and EMH students. School administrators, cognizant of differences among student groups in music achievement, are better able to schedule music classes for the best possible music instruction.

Implications for the Teacher

The analysis of data has resulted in finding significant differences among GT, average, and EMH students for pitch discrimination and in total test scores for MAT 1 and MAT 2. GT test scores, with the exception of tonal center discrimination, were found significantly different than EMH or average student test scores. Through the application of the findings of this study, elementary music educators can better design educational objectives; and, plan and implement more precise and efficient lessons, based upon these specific group abilities.

Differences in achievement of pitch, major-minor, and audiovisual discrimination were greatest among all subtests. While all music achievement test scores in the multivariate analysis were found to be significant at the identical probability level (p = .0001), pitch, major-minor, and audiovisual discrimination resulted in larger differences among subjects. All other subtests exhibited smaller, though significant, differences among subjects.

Pitch discrimination is the variable that best differentiates among subject groups. GT students scored significantly higher than other subjects on each of the six subtest variables, but obtained in particular higher scores on pitch discrimination. It can, therefore, be assumed that GT students require less time working on pitch discrimination during music classes than do average or EMH students. EMH students will need the most amount of time and training when compared to other subjects in pitch discrimination.

Average and EMH students scored significantly lower than GT students on the major-minor discrimination subtest. An implication drawn from this finding can influence music teachers to plan more experiences, expanded discussions, and examples of major-minor tonality for EMH and average students. GT students have been found to discriminate between major and minor modes better than other subjects, and therefore should require less practice in major-minor discrimination.

Using the results of the auditory-visual subtest, the author has concluded that significant differences in music reading skills and level of musical understanding exist among GT and average students, and GT and EMH students. GT students have been shown to have the greatest ability among subjects in comprehending musical notation. Average students were not superior to EMH students in recalling musical terminology and recognizing note types. It can be assumed from the results of this study that elementary music teachers should offer increased and continuous instruction in musical notation to average and EMH students. GT students should require the least amount of study in musical notation.

Implications for the Administrator

It is recommended that administrators be made aware of the significant differences in music achievement among GT, average, and EMH students. To place dissimilar student groups together can result in a loss of education in music for all students. Music classes should be conducted at an appropriate ability level for each student group. In consideration of achievement differences in reading and mathematics, students are not usually mainstreamed in these areas. Music classes warrant the same treatment.

The results of this study can assist administrators in making decisions concerning the placement and grouping of students. EMH and average students, according to the post hoc analysis, can be mainstreamed. Both of these student groups show similar abilities in all subtests of MAT 1 and MAT 2 except pitch discrimination. Therefore, the mainstreaming of EMH with average students should not be an instructional liability to an effective music program. GT students, however, should not be mainstreamed with either average or EMH students. The differences between GT and other student groups are significant to the level that, if GT students were combined with EMH or average students, this situation could promote boredom among GT students if instruction is directed toward average students, or "lose" average students if instruction is structured for GT students.

Comparison with Previous Findings

The results of the present study closely parallel those obtained by Bailey (1975). He found that students with higher IQ test scores also scored the highest on MAT 1 and MAT 2. Student interest and involvement in music were also found to be significant factors in music achievement test scores in both studies.

IQ has been identified by Wermuth (1971), Bailey (1975), and McCarthy (1980) as a significant predictor variable for music achievement. Ianacone (1976), however, determined that IQ was a variable with minimal predictor value. In the present study, the regression analysis of MAT 2 shows agreement with the conclusions reached by Wermuth, Bailey, and McCarthy, that IQ is a significant predictor

(p = .03) of music achievement. For MAT 1, IQ was found not to be a significant predictor (p = .84) of music achievement.

Sex apparently is not a significant predictor for either MAT 1 or MAT 2. This finding is in agreement with McCarthy (1980), but not in accordance with Jarrell (1971).

Differences in tonal memory subtest scores among the three student groups closely parallel research conducted in general memory differences. GT students showed greater test scores in tonal memory than either average or EMH students. Roger et al. (1978) suggests this is a result of a richer prior knowledge by GT students because of greater involvement in musical activities. Thus, it is concluded that tonal memory is a significant predictor of music achievement, and is a major difference among GT, average, and EMH students.

Results from this study show mathematic achievement and reading achievement to be poor predictors of music achievement. Cummins and Das (1980) and Karol (1979) have concluded that EMH students differ from average or GT students in reading ability due to a lack of attention to relevant stimuli. It was this researcher's observation that all students, regardless of group, were attentive to test directions and followed each instruction carefully. It should be noted, however, the author's contact with subjects was limited to four half-hour sessions.

Considerations for Interpretation

The results of this study may have been affected by the test-taking experiences of the subjects. All subjects had, in close proximity to the present study, completed the North Carolina Annual Testing

Program. Many of the students may have used this prior experience to achieve higher music test scores, while conversely other students may have been tired of the testing routine, adversely affecting their music test scores.

Music achievement test results may have been affected by a testing schedule during the late spring. Subjects may have benefited through increased experience in music classes resulting in higher music achievement test scores than subjects examined in the fall season. While the range of music achievement test scores may change throughout the school year, differences in music achievement among GT, average, and EMH students should generally remain the same.

Subjects who were accustomed to female teachers may have responded differently to the male researcher. In addition, each music test appeared to be novel and a sometimes interesting stimulus. In participating in an unusual experience, some subjects may have been stimulated to higher music achievement test scores, while other students may have been intimidated by the new stimuli.

Suggestions for Future Research

The findings of this study can be utilized as a beginning for understanding how students differ in music achievement. Further research possibilities could parallel studies of sex differences in mathematics. For example, do differences in music achievement vary with age? Will differences exhibited by subjects remain the same throughout the public school experience or will differences in music achievement increase or decrease? Additional research into memory (both tonal memory and also general memory ability) is needed to assess the role memory ability plays in levels of music achievement. Unlike previous research, this study did not examine the relationship between instrumental and keyboard experience in music achievement.

While student interest was found significant at $p = .05$, many EMH students showed an interest in music but had limited experience. Average and GT students indicated that they were more experienced in band, orchestra, and keyboard instruments. As these activities frequently require financial support, socioeconomic status should be considered in future research. Interest in music may also be affected by parental ability to offer additional training in music. In addition, the attitudes of classroom teachers should be studied to determine the nature of the effect of teacher attitude on student interest in music.

This study is intended to validate many beliefs educators maintain about differences among GT, average, and EMH students. While this study is not presented as a total explanation of the musical differences among GT, average, and EMH students, it informs music educators and school administrators of student differences in music classes. By explaining specific differences in music achievement among student groups, the results of this study allow music educators the opportunity to educate each student at an appropriate level of ability.

BIBLIOGRAPHY

Aiden, L. R. Ability and creativity in math. Review of Educational Research, 1973, 43, 405-432.

Alvino, J. Do gifted and nongifted children learn differently? Principal, 1981, 60, 38-40.

Bailey, J. Z. Colwell MAT 1 and 2, SRA, IQ: Success in instrumental music grade six (Doctoral dissertation, University of Illinois at Urbana-Champaign, 1975). Dissertation Abstracts International, 1975, 35 5904A. (University Microfilms No. 76-6685)

Benbow, C. P., & Stanley, J. C. Sex differences in mathematical ability: Fact or artifact. Science, 1980, 210, 1263-1264.

Bergman, L. R. Is intellectual development more vulnerable in boys than in girls? Journal of Genetic Psychology, 1981, 138, 175-181.

Berk, R. A., Bridges, W. P., & Shih, A. Does IQ really matter? A study of the use of IQ scores for the tracking of the mentally retarded. American Sociological Review, 1981, 46, 58-71.

Blosser, G. H. Group intelligence tests as screening devices in locating gifted and superior students in the ninth grade. Exceptional Children, 1963, 29, 282-287.

Bos, C. S. Inferential operations in the reading comprehension of educable mentally retarded and average students (Doctoral dissertation, University of Arizona, 1979). Dissertation Abstracts International, 1979, 40, 3227A. (University Microfilms No. 79-27581)

Brimer, M. A. Sex differences in listening comprehension. Journal of Research and Development in Education, 1969, 3, 72-79.

Brown, A., Campione, J. C., & Murphy, M. Keeping track of changing variables: Long-term retention of a trained rehearsal strategy by retarded adolescents. American Journal of Mental Deficiency, 1974, 78, 446-453.

Brown, A. L. Conservation of number and continuous quantity in normal, bright, and retarded children. Child Development, 1973, 44, 376-379.

Brown, R. I. The effects of extraneous auditory stimulation on learning and performance. American Journal of Mental Deficiency, 1966, 71, 283-290.

Bruscia, K. E. Auditory short-term memory and attention control of mentally retarded persons. American Journal of Mental Deficiency, 1981, 85, 435-437.

Colwell, R. Music achievement tests. Chicago: Follett Educational Corporation, 1969.

Colwell, R. The evaluation of music teaching and learning. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1970.

Comprehensive test of basic skills (Expanded ed.). Monterey, Calif.: McGraw-Hill, 1976.

Cooley, J. C. A study of the relation between certain mental personality traits and ratings of musical abilities. Journal of Research in Music Education, 1961, 9, 108-117.

Crosby, K. G., & Blatt, B. Attention and mental retardation. Journal of Education, 1968, 150, 67-81.

Cummins, J. P., & Das, J. P. Cognitive processing, academic achievement and WISC-R performance in EMR children. Journal of Consulting and Clinical Psychology, 1980, 48, 777-779.

Daneman, M., & Carpenter, P. Individual differences in working memory and reading. Journal of Reading Behavior, 1980, 19, 450-466.

DeBoth, C., & Dominowski, R. Individual differences in learning: Visual versus auditory presentation. Journal of Educational Psychology, 1978, 70, 498-503.

Deceuir, A., & Braswell, C. A music profile for a sample of learning-disabled children and adolescents: A pilot study. Perceptual and Motor Skills, 1978, 46, 1080-1082.

Denny, M. R. A theoretical analysis and its application to training the mentally retarded. In N. R. Ellis (Ed.), International review of research in mental retardation (Vol. 2). New York: Academic Press, 1966.

Dimond, M. L. A comparison of the Seashore Measures of Musical Talents Sub-test scores with academic and vocational success (Doctoral dissertation, University of Missouri at Columbia, 1974). Dissertation Abstracts International, 1975, 35, 6493A. (University Microfilms No. 75-5739)

Feibel, D. K. Memory for sentences in gifted, average, and poor readers (Doctoral dissertation, University of Rochester, 1979). Dissertation Abstracts International, 1979, 40, 1355A. (University Microfilms No. 79-17182)

Ford, M. E., & Keating, D. P. Developmental differences in long-term memory retrieval: Process and organization. Child Development, 1981, 52, 234-241.

Gagné, R. M. (Ed.). Learning and individual differences. Columbus, Ohio: Merrill Books, Inc., 1967.

Gaston, E. T. A test of musicality. Lawrence, Kansas: Odell's Instrumental Service, 1957.

Gates, A. I. Sex differences in reading ability. Elementary School Journal, 1961, 61, 431-434.

Gillette, A. I. Learning and retention: A comparison of three experimental procedures. Archives of Psychology, 1936, 198.

Given, G., & Zigler, E. Expectancy of success and the probability learning of middle-class, lower-class and retarded children. Journal of Abnormal Psychology, 1968, 73, 343-352.

Goldberg, R. A., Swartz, S., & Stewart, M. Individual cognitive processes. Journal of Educational Psychology, 1977, 69, 9-14.

Goldstein, K. Concerning rigidity. Character and Personality, 1943, 11, 209-226.

Gregory, S. C., & Bunch, M. E. The relative retentive abilities of fast and slow learners. Journal of General Psychology, 1959, 60, 173-181.

Hagen, J. C. Concept formation in average, gifted and highly gifted children (Doctoral dissertation, University of California at Los Angeles, 1979). Dissertation Abstracts International, 1979, 39, 7281A. (University Mocrofilms No. 79-12510)

Hagen, J. W., & Huntsman, N. J. Selective attention in mental retardates. Developmental Psychology, 1971, 5, 151-160.

Hall, E. P. Sex differences in IQ development and correlated variables for intellectually gifted students (Doctoral dissertation, University of Michigan, 1978). Dissertation Abstracts International, 1978, 39, 775A. (University Microfilms No. 78-113662)

Hampleman, R. S. Comparison of listening and reading comprehension ability of fourth and fifth graders (Doctoral dissertation, Indiana University, 1955). Dissertation Abstracts International, 1955, 15, 1757A.

Hashway, R. M. Sex differences in mathematics achievement: Are they real? Phi Delta Kappan, 1981, 63, 139-140.

Heal, L. W., Ross, L. E., & Sanders, B. Reversal and partial reversal in mental defectives and normal children of a comparable mental age. American Journal of Mental Deficiency, 1966, 71, 411-416.

Hilton, T. L., & Berglund, G. W. Sex differences in mathematics achievement: A longitudinal study. Journal of Educational Research, 1974, 64, 231-237.

Hunt, E. Individual differences in the acquisition of knowledge. In R. C. Anderson, R. J. Spiro, & W. L. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N.J.: Erlbaum, 1977.

Hunt, E., Frost, N., & Lunneborg, C. I. Individual differences in cognition: A new approach to intelligence. In G. Bower (Ed.), Advances in learning and motivation (Vol. 7). New York: Academic Press, 1973.

Hunt, E., Lunneborg, C., & Lewis, J. What does it mean to be high verbal? Cognitive Psychology, 1975, 7, 194-227.

Ianacone, R. N. Music aptitude measures in EMH students (Doctoral dissertation, University of Florida, 1976). Dissertation Abstracts International, 1976, 38, 6403A. (University Microfilms No. 77-8189)

Jamieson, D. G. Listening abilities of gifted and average intermediate grade students in response to normal and time-compressed speech versions of literacy and expository selections (Doctoral dissertation, University of Washington, 1979). Dissertation Abstracts International, 1979, 40, 647A. (University Microfilms No. 79-17584)

Jarrell, J. A. An analysis of achievement, procedures, and activities of selected high school band programs in Oklahoma (Doctoral dissertation, University of Oklahoma, 1971). Dissertation Abstracts International, 1971, 32, 4045A. (University Microfilms No. 72-3400)

Kaplan, P. R. A criterion-referenced comparison of rhythmic responsiveness in normal and educable mentally retarded children (mental ages 6-8) (Doctoral dissertation, University of Michigan, 1977). Dissertation Abstracts International, 1977, 38, 3354-3555. (University Microfilms No. 77-26277)

Karnes, F. A., & Brown, K. E. Sex differences in the WISC-R scores of gifted students. Psychology in the Schools, 1980, 17, 361-363.

Karol, L. G. A study of differential performance between normal and poor readers on immediate recognition and retention of visual stimuli (Doctoral dissertation, Saint Louis University, 1978). Dissertation Abstracts International, 1979, 39, 6032A. (University Microfilms No. 79-8286)

Krupski, A. Are retarded children more distractable? Observational analysis of retarded and nonretarded children's classroom behavior. American Journal of Mental Deficiency, 1979, 84, 1-10.

Lao, R. C. Differential factors affecting male and female academic performance in high school. Journal of Psychology, 1980, 104, 119-127.

Leinhardt, G., Seewald, A. M., & Engel, M. Learning what's taught: Sex differences in instruction. Journal of Educational Psychology, 1979, 71, 432-439.

Maccoby, E. E. (Ed.). The development of sex differences. Stanford: Stanford University Press, 1966.

Mann, R. E. The effect of music and sound effects on the listening comprehension of fourth-grade students (Doctoral dissertation, North Texas State University, 1979). Dissertation Abstracts International, 1979, 40, 1220A. (University Microfilms No. 79-19733)

Marshall, M. F. Auditory-visual and spatial-temporal integration abilities of above average and below average readers (Doctoral dissertation, University of British Columbia, 1979). Dissertation Abstracts International, 1979, 40, 1966A.

Marshall, S. P. Sex differences in sixth-grade children's problem-solving. Paper presented at the Annual Meeting of the American Educational Research Association (65th, Los Angeles, California, April 13-17, 1981).

McCarthy, J. F. Individual instruction: Student achievement and drop-out in an urban elementary instrumental music program. Journal of Research in Music Education, 1980, 28, 59-69.

Morelan, S. J. IQ, mental age, complexity, and trial blocks and the response latency of retarded and nonretarded children. American Journal of Mental Deficiency, 1976, 80, 437-441.

Mosley, M. H. The relationship between intelligence and two major categories of reading comprehension: Literal-explicit and inferential-explicit (Doctoral dissertation, North Texas State University, 1978). Dissertation Abstracts International, 1978, 39, 4098A. (University Microfilms No. 78-24659)

Nidiffer, D. F., & Fowler, S. C. Nonretarded and mentally retarded children's performance on a manual control task with and without visual feedback. American Journal of Mental Deficiency, 1981, 85, 521-529.

North Carolina State Department of Public Instruction. Rules governing programs and services for children with special needs. Raleigh: Author, 1980.

Pegnato, C. C., & Birch, J. W. Locating gifted children in junior high school. Exceptional Children, 1959, 23, 300-304.

Peters, M. A comparison of the musical sensitivity of mongoloid and normal children. Journal of Music Therapy, 1970, 7, 113-123.

Plomin, R., & Foch, T. T. Sex differences and individual differences. Child Development, 1981, 52, 383-385.

Rich, H. L. Educationally handicapped children's locus of control and reading achievement. Exceptional Child, 1981, 48, 244-248.

Richman, C. L. Performance of MA-matched nonretarded and retarded children on discrimination learning and transfer-shift tasks. American Journal of Mental Deficiency, 1978, 83, 262-269.

Ross, D. M., Ross, S. A., & Kuchenbecker, S. L. Rhythm training for educable mentally retarded children. Mental Retardation, 1973, 11, 20-23.

Royer, J. M., Hambleton, R. K., & Cadorette, L. Individual differences in memory: Theory, data, and educational implications. Contemporary Educational Psychology, 1978, 3, 182-203.

Russell, D. Personal communication, March 16, 1982.

Schoer, L. Effect of list length and interpolated learning on the learning and recall of fast and slow learners. Journal of Educational Psychology, 1962, 53, 193-197.

Seashore, C., Lewis, D., & Saetveit, J. The Seashore measures of musical talent. New York: The Psychological Corporation, 1960.

Sen A., & Clarke, A. M. The effect of distraction during and after learning a serial recall task. American Journal of Mental Deficiency, 1968, 73, 46-49.

Shuell, T. J., & Keppel, G. Learning ability and retention. Journal of Educational Psychology, 1970, 61, 59-65.

Smisek, S. O. Differences between good/average comprehenders and poor comprehenders on recall of expository material at each level of use of top-level structure as an organizational strategy of recall (Doctoral dissertation, Florida Atlantic University 1980). Dissertation Abstracts International, 1980, 41, 1008A. (University Microfilms No. 80-19983)

Smith, J., Kaufman, H., & Dutch, S. Identification by retarded and nonretarded children of stimuli varying among one, two or three dimensions. American Journal of Mental Deficiency, 1975, 80, 191-196.

Smith, R. An introduction to mental retardation. New York: McGraw-Hill, 1971.

Statistical Analysis System. SAS user's guide (1979 ed.). Cary, N.C.: Author, 1979.

Sullivan, E., Clark, W., & Tiegs, E. Short form test of academic aptitude. Monterey, Calif.: McGraw-Hill, 1970.

Swickard, J. H. A comparative study of music achievement in grades four, five and six (Doctoral dissertation, University of Illinois at Urbana-Champaign, 1971). Dissertation Abstracts International, 1971, 32, 4653A. (University Microfilm No. 72-7082)

Taylor, B. M. A comparison of good and poor readers' ability to read for meaning (Doctoral dissertation, Virginia Polytechnic Institutue and State University, 1978). Dissertation Abstracts International, 1978, 39, 2108A. (University Microfilms No. 78-18560)

Underwood, B. J. Speed of learning and amount retained: A consideration of methodology. Psychological Bulletin, 1954, 51, 276-282.

Ward, M. G. Differences in the ability levels and growth gains in three higher cognitive processes among gifted and nongifted sixth-grade students (Doctoral dissertation, University of South Carolina, 1979). Dissertation Abstracts International, 1979, 40, 3960A. (University Microfilms No. 80-02282)

Weisberg, R. K. A comparison of good and poor readers' ability to understand explicit and implicit information in short stories based on two modes of presentation (Doctoral dissertation, Temple University, 1978). Dissertation Abstracts International, 1978, 39, 2792A. (University Microfilms No. 78-12252)

Weiss, J. R., & Auchenbach, T. M. Effects of IQ and mental age on hypothesis behavior in normal and retarded children. Developmental Psychology, 1975, 11, 304-310.

Weisz, J. R., & Yeates, K. O. Cognitive development in retarded and nonretarded persons: Piagetian tests of similar structure hypothesis. Psychological Bulletin, 1981, 90, 153-178.

Wermuth, R. F. Relationship of musical aptitude to family and student activity in music, student interest in music, socioeconomic status, and intelligence among Caucasian and Negro middle school students (Doctoral dissertation, Ohio State University, 1971). Dissertation Abstracts International, 1971, 32, 4054A. (University Microfilms No. 72-4689)

Winkel, K. W. Listener reaction profiles and their relationship with music achievement, music aptitude, music background, sex and reading achievement (Doctoral dissertation, University of Iowa, 1980). Dissertation Abstracts International, 1980, 41, 1465A-1466A. (University Microfilms No. 80-22089)

Yarborough, B. H., & Johnson, R. H. A six-year study of sex differences in intellectual functioning, reading/language arts achievement and affective development. Journal of Psychology, 1980, 106, 55-61.

Zeaman, D. One programmatic approach to retardation. In D. K. Routh (Ed.), The experimental psychology of mental retardation. Chicago: Aldine Publishing Inc., 1973.

Zeaman, D., & House, B. J. The role of attention in retardate discrimination learning. In N. R. Ellis (Ed.), Handbook of mental deficiency. New York: McGraw-Hill, 1963.

Zigler, E. Developmental versus difference theories of mental retardation and the problem of motivation. American Journal of Mental Deficiency, 1969, 73, 536-556.

APPENDIX A

TEST FORM FOR ASSESSING NOTATIONAL SKILLS

NAME____________________ TEACHER_______________ GRADE___

1\.

(1) 1 2 S (2) 1 2 S (3) 1 2 S (4) 1 2 S

(5) 1 2 S (6) 1 2 S

(16) 1 2 3 (17) 1 2 3 (18) 1 2 3 (19) 1 2 3

2\.

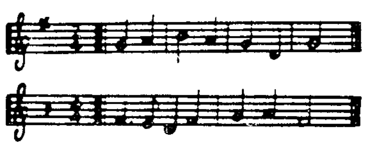
(1) M m (2) M m (3) M m (4) M m (5) M m (6) M m

(16) M m C (17) M m C (18) M m C (19) M m C

(20) M m C

(39) 1 2 3 0 (40) 1 2 3 0 (41) 1 2 3 0 (42) 1 2 3 0

3\.



SAME......NOTE.....RHYTHM....

SAME......NOTE.....RHYTHM....

	NOTE	RHYTHM	SAME
1st time...	☐	☐	☐
2nd time...	☐	☐	☐
3rd time...	☐	☐	☐

	NOTE	RHYTHM	SAME
1st time...	☐	☐	☐
2nd time...	☐	☐	☐
3rd time...	☐	☐	☐

4\.

A

	1	2	3
1	☐	☐	☐
2	☐	☐	☐
3	☐	☐	☐

B

	1	2	3	4
1	☐	☐	☐	☐
2	☐	☐	☐	☐
3	☐	☐	☐	☐

C

	1	2	3	4	5
1	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐

APPENDIX B

TABLE A

DESCRIPTIVE DATA: TOTAL SAMPLE

Table A

Descriptive Data: Total Sample

Variable	N	Mean	Median	SD	Kurtosis	Skewness
Pitch Discrimination	287	14.44	14	6.06	1.15	0.05
Interval Discrimination	287	13.43	14	3.53	1.33	-0.16
Meter Discrimination	287	15.63	16	5.16	0.07	0.08
Major-Minor Discrimination	286	14.19	13	4.41	0.66	0.84
Tonal Center Discrimination	286	7.37	7	3.15	0.54	0.78
Auditory-Visual Discrimination	286	18.72	17	8.89	1.54	1.13
Music Aptitude	285	29.78	29	8.73	-0.56	0.17
Tonal Memory	287	17.88	19	7.67	-1.23	-0.14
Interest in Music	285	6.32	6	2.52	-0.54	0.11
Reading Achievement	255	419.36	445	86.73	-1.13	-0.48
Mathematics Achievement	255	390.71	417	73.18	-0.69	-0.73
Mental Age	282	11.99	12.5	2.90	-0.86	-0.37

APPENDIX C

DESCRIPTIVE DATA: BY SCHOOL GROUP

Table B

Educable Mentally Handicapped Students

Variable	N	Mean	Median	SD	Kurtosis	Skewness
Pitch Discrimination	64	7.94	8	2.98	-0.64	-0.01
Interval Discrimination	64	12.08	12.5	3.23	-0.60	-0.24
Meter Discrimination	64	13.70	14	4.54	-0.42	0.13
Major-Minor Discrimination	64	11.83	12	3.12	0.44	-0.25
Tonal Center Discrimination	64	5.22	5	2.09	-0.09	0.41
Auditory-Visual Discrimination	64	14.25	14	5.23	-0.06	0.73
Music Aptitude	64	22.80	23	6.13	-0.02	0.05
Tonal Memory	64	8.89	8	3.42	6.73	1.56
Interest in Music	64	5.72	5	1.95	-0.38	-0.02
Reading Achievement	64	295.78	292.5	28.91	1.87	-0.10
Mathematics Achievement	64	283.75	285	33.71	0.90	0.27
Mental Age	64	7.83	7.8	0.99	-0.04	-0.28

Table C

Average Students

Variable	N	Mean	Median	SD	Kurtosis	Skewness
Pitch Discrimination	116	14.53	14.5	5.22	-1.12	0.14
Interval Discrimination	116	13.16	13	3.78	0.65	-0.10
Meter Discrimination	116	14.66	14	5.22	0.74	0.50
Major-Minor Discrimination	116	13.37	13	3.31	1.57	0.89
Tonal Center Discrimination	116	7.22	7	2.74	0.99	0.78
Auditory-Visual Discrimination	116	17.15	16	8.12	0.90	0.89
Music Aptitude	115	28.08	27	7.83	-0.55	0.40
Tonal Memory	116	16.78	17	6.26	-0.75	-0.02
Interest in Music	115	5.97	6	2.53	-0.32	0.11
Reading Achievement	100	424.13	423	48.68	-0.85	0.05
Mathematics Achievement	100	402.08	406	40.12	2.75	-0.69
Mental Age	111	12.04	12.17	1.82	0.53	-0.17

Table D

Gifted and Talented Students

Variable	N	Mean	Median	SD	Kurtosis	Skewness
Pitch Discrimination	107	18.24	20	4.93	-0.71	-0.53
Interval Discrimination	107	14.53	15	3.08	4.94	-0.08
Meter Discrimination	107	17.84	18	4.67	1.13	-0.46
Major-Minor Discrimination	106	16.50	15.5	5.05	-0.78	0.43
Tonal Center Discrimination	106	8.83	8	3.33	-0.18	0.59
Auditory-Visual Discrimination	106	23.13	21	9.56	0.81	1.05
Music Aptitude	106	35.83	36	6.87	-0.42	0.12
Tonal Memory	107	24.45	25	3.97	-0.49	-0.53
Interest in Music	106	7.06	7	2.66	-0.95	-0.08
Reading Achievement	92	495.61	509	55.67	68.92	-7.76
Mathematics Achievement	91	453.42	455	17.20	-0.49	-0.02
Mental Age	107	14.43	14.42	1.34	0.46	0.08

APPENDIX D

TABLE E

CORRELATION MATRIX

	MAT11	MAT12	MAT13	MAT1TOT	IQ	MENTAGE
MAT11 MAT1 PITCH DISCRIMINATION	1.00000 0.0000 287	0.21618 0.0002 287	0.40397 0.0001 287	0.80432 0.0001 287	0.66326 0.0001 282	0.64543 0.0001 282
MAT12 MAT1 INTERVAL DISCRIMINATION	0.21618 0.0002 287	1.00000 0.0000 287	0.31510 0.0001 287	0.58169 0.0001 287	0.25700 0.0001 282	0.25376 0.0001 282
MAT13 MAT1 METER DISCRIMINATION	0.40397 0.0001 287	0.31510 0.0001 287	1.00000 0.0000 287	0.78924 0.0001 287	0.30448 0.0001 282	0.29716 0.0001 282
MAT1TOT MAT1 TOTAL SCORE	0.80432 0.0001 287	0.58169 0.0001 287	0.78924 0.0001 287	1.00000 0.0000 287	0.58411 0.0001 282	0.57093 0.0001 282
IQ	0.66326 0.0001 282	0.25700 0.0001 282	0.30448 0.0001 282	0.58411 0.0001 282	1.00000 0.0000 282	0.96305 0.0001 282
MENTAGE MENTAL AGE	0.64543 0.0001 282	0.25376 0.0001 282	0.29716 0.0001 282	0.57093 0.0001 282	0.96305 0.0001 282	1.00000 0.0000 282
READACH READING ACHIEVEMENT	0.68592 0.0001 255	0.26419 0.0001 255	0.34080 0.0001 255	0.61184 0.0001 255	0.91538 0.0001 254	0.88526 0.0001 254
MAT21 MAT2 MAJOR MINOR DISCRIMINATION	0.44347 0.0001 286	0.25209 0.0001 286	0.37641 0.0001 286	0.49899 0.0001 286	0.40934 0.0001 281	0.38228 0.0001 281
MAT22 MAT2 TONAL CENTER DISCRIMINATION	0.49493 0.0001 286	0.23846 0.0001 286	0.35272 0.0001 286	0.51560 0.0001 286	0.43452 0.0001 281	0.41170 0.0001 281
MAT23 MAT2 AUDITORY VISUAL DISCRIMINATION	0.50292 0.0001 286	0.33905 0.0001 286	0.38282 0.0001 286	0.56344 0.0001 286	0.42253 0.0001 281	0.39470 0.0001 281
MAT2TOT MAT2 TOTAL SCORE	0.59150 0.0001 286	0.36793 0.0001 286	0.45697 0.0001 286	0.65549 0.0001 286	0.51661 0.0001 281	0.48253 0.0001 281
MATHACH MATH ACHIEVEMENT	0.62001 0.0001 255	0.23715 0.0001 255	0.29629 0.0001 255	0.54644 0.0001 255	0.87704 0.0001 254	0.84814 0.0001 254
MUSICAPT MUSIC APTITUDE TEST SCORE	0.62067 0.0001 285	0.34195 0.0001 285	0.42400 0.0001 285	0.64471 0.0001 285	0.58285 0.0001 280	0.56993 0.0001 280
TONALMEM TONAL MEMORY TEST SCORE	0.69048 0.0001 287	0.30450 0.0001 287	0.41395 0.0001 287	0.66444 0.0001 287	0.77252 0.0001 282	0.75473 0.0001 282
INTEREST INTEREST IN MUSIC	0.27076 0.0001 285	0.32244 0.0001 285	0.22742 0.0001 285	0.35214 0.0001 285	0.20436 0.0006 280	0.15794 0.0081 280
SEX	0.06937 0.2414 287	0.09371 0.1132 287	0.09180 0.1207 287	0.10885 0.0655 287	0.08675 0.1462 282	0.07696 0.1976 282
SCHOOLGP SCHOOL GROUP EMH,AVERAGE,OR GT	0.62552 0.0001 287	0.26734 0.0001 287	0.32145 0.0001 287	0.57160 0.0001 287	0.87983 0.0001 282	0.84586 0.0001 282

(continued)

	READACH	MAT21	MAT22	MAT23	MAT2TOT	MATHACH
MAT11 MAT1 PITCH DISCRIMINATION	0.68592 0.0001 255	0.44347 0.0001 286	0.49493 0.0001 286	0.50292 0.0001 286	0.59150 0.0001 286	0.62001 0.0001 255
MAT12 MAT1 INTERVAL DISCRIMINATION	0.26419 0.0001 255	0.25269 0.0001 286	0.23846 0.0001 286	0.33905 0.0001 286	0.36793 0.0001 286	0.23715 0.0001 255
MAT13 MAT1 METER DISCRIMINATION	0.34060 0.0001 255	0.37641 0.0001 286	0.35272 0.0001 286	0.38282 0.0001 286	0.45697 0.0001 286	0.29629 0.0001 255
MAT1TOT MAT1 TOTAL SCORE	0.61184 0.0001 255	0.49899 0.0001 286	0.51560 0.0001 286	0.56344 0.0001 286	0.65549 0.0001 286	0.54644 0.0001 255
IQ	0.91538 0.0001 254	0.40934 0.0001 281	0.43452 0.0001 281	0.42253 0.0001 281	0.51661 0.0001 281	0.87704 0.0001 254
MENTAGE MENTAL AGE	0.885[illegible]8 0.0001 254	0.38228 0.0001 281	0.41170 0.0001 281	0.39470 0.0001 281	0.48253 0.0001 281	0.84814 0.0001 254
READACH READING ACHIEVEMENT	1.00000 0.0000 255	0.40922 0.0001 254	0.44588 0.0001 254	0.39143 0.0001 254	0.50636 0.0001 254	0.91551 0.0001 255
MAT21 MAT2 MAJOR MINOR DISCRIMINATION	0.40922 0.0001 254	1.00000 0.0000 286	0.40634 0.0001 286	0.48590 0.0001 286	0.74006 0.0001 286	0.34616 0.0001 254
MAT22 MAT2 TONAL CENTER DISCRIMINATION	0.44588 0.0001 254	0.40634 0.0001 286	1.00000 0.0000 286	0.37855 0.0001 286	0.62024 0.0001 286	0.36368 0.0001 254
MAT23 MAT2 AUDITORY VISUAL DISCRIMINATION	0.39143 0.0001 254	0.48590 0.0001 286	0.37855 0.0001 286	1.00000 0.0000 286	0.90911 0.0001 286	0.35046 0.0001 254
MAT2TOT MAT2 TOTAL SCORE	0.50636 0.0001 254	0.74006 0.0001 286	0.62024 0.0001 286	0.90911 0.0001 286	1.00000 0.0000 286	0.43878 0.0001 254
MATHACH MATH ACHIEVEMENT	0.91551 0.0001 255	0.34616 0.0001 254	0.36368 0.0001 254	0.35046 0.0001 254	0.43878 0.0001 254	1.00000 0.0000 255
MUSICAPT MUSIC APTITUDE TEST SCORE	0.61650 0.0001 254	0.47425 0.0001 284	0.48400 0.0001 284	0.56008 0.0001 284	0.63566 0.0001 284	0.52533 0.0001 254
TONALMEM TONAL MEMORY TEST SCORE	0.77748 0.0001 255	0.51278 0.0001 286	0.50927 0.0001 286	0.49806 0.0001 286	0.61894 0.0001 286	0.71542 0.0001 255
INTEREST INTEREST IN MUSIC	0.23965 0.0001 254	0.39907 0.0001 284	0.23927 0.0001 284	0.38617 0.0001 284	0.44859 0.0001 284	0.18660 0.0028 254
SEX	0.19273 0.0020 255	0.23703 0.0001 286	0.11440 0.0533 286	0.08482 0.1525 286	0.16373 0.0055 286	0.14993 0.0166 255
SCHOOLGP SCHOOL GROUP EMH,AVERAGE,OR GT	0.89980 0.0001 255	0.41532 0.0001 286	0.42942 0.0001 286	0.39254 0.0001 286	0.50144 0.0001 286	0.87243 0.0001 255

(continued)

	MUSICAPT	TONALMEM	INTEREST	SEX	SCHOOLGP
MAT11 MAT1 PITCH DISCRIMINATION	0.62067 0.0001 285	0.69048 0.0001 287	0.27076 0.0001 285	0.06937 0.2414 287	0.62552 0.0001 287
MAT12 MAT1 INTERVAL DISCRIMINATION	0.34195 0.0001 285	0.30450 0.0001 287	0.32244 0.0001 285	0.09371 0.1132 287	0.26734 0.0001 287
MAT13 MAT1 METER DISCRIMINATION	0.42400 0.0001 285	0.41395 0.0001 287	0.22742 0.0001 285	0.09180 0.1207 287	0.32145 0.0001 287
MAT1TOT MAT1 TOTAL SCORE	0.64471 0.0001 285	0.66444 0.0001 287	0.35214 0.0001 285	0.10885 0.0655 287	0.57160 0.0001 287
IQ	0.58285 0.0001 280	0.77252 0.0001 282	0.20436 0.0006 280	0.08675 0.1462 282	0.87983 0.0001 282
MENTAGE MENTAL AGE	0.56993 0.0001 280	0.75473 0.0001 282	0.15794 0.0081 280	0.07696 0.1976 282	0.84586 0.0001 282
READACH READING ACHIEVEMENT	0.61650 0.0001 254	0.77740 0.0001 255	0.23965 0.0001 254	0.19273 0.0020 255	0.89980 0.0001 255
MAT21 MAT2 MAJOR MINOR DISCRIMINATION	0.47425 0.0001 284	0.51278 0.0001 286	0.39907 0.0001 284	0.23703 0.0001 286	0.41532 0.0001 286
MAT22 MAT2 TONAL CENTER DISCRIMINATION	0.48400 0.0001 284	0.50927 0.0001 286	0.23927 0.0001 284	0.11440 0.0533 286	0.42942 0.0001 286
MAT23 MAT2 AUDITORY VISUAL DISCRIMINATION	0.56008 0.0001 284	0.49806 0.0001 286	0.38617 0.0001 284	0.08482 0.1525 286	0.39254 0.0001 286
MAT2TOT MAT2 TOTAL SCORE	0.63566 0.0001 284	0.61894 0.0001 286	0.44859 0.0001 284	0.16373 0.0055 286	0.50144 0.0001 286
MATHACH MATH ACHIEVEMENT	0.52533 0.0001 254	0.71542 0.0001 255	0.18680 0.0028 254	0.14993 0.0166 255	0.87243 0.0001 255
MUSICAPT MUSIC APTITUDE TEST SCORE	1.00000 0.0000 285	0.65095 0.0001 285	0.32981 0.0001 285	0.14811 0.0123 285	0.57800 0.0001 285
TONALMEM TONAL MEMORY TEST SCORE	0.65095 0.0001 285	1.00000 0.0000 287	0.29224 0.0001 285	0.13430 0.0229 287	0.76789 0.0001 287
INTEREST INTEREST IN MUSIC	0.32981 0.0001 285	0.29224 0.0001 285	1.00000 0.0000 285	0.16630 0.0049 285	0.21441 0.0003 285
SEX	0.14811 0.0123 285	0.13430 0.0229 287	0.16630 0.0049 285	1.00000 0.0000 287	0.15092 0.0105 287
SCHOOLGP SCHOOL GROUP EMH,AVERAGE,OR GT	0.57800 0.0001 285	0.76789 0.0001 287	0.21441 0.0003 285	0.15092 0.0105 287	1.00000 0.0000 287

APPENDIX E

STEPWISE ANALYSIS: MAT 1

Table F

Stepwise Regression: Best Four

Variable Model for MAT 1

R Square = 0.53					
Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
Achievement	4	16055.72	4013.93	71.16	0.0001
Error	248	13989.28	56.41		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	*F*	*p*
Intercept	13.29				
Reading Achievement	0.02	0.01	254.81	4.52	0.03
Music Aptitude	0.38	0.07	1505.59	26.69	0.0001
Tonal Memory	0.44	0.10	1011.71	17.94	0.0001
Interest in Music	0.46	0.20	300.71	5.33	0.02

Table G

Stepwise Regression: Best Five

Variable Model for MAT 1

R Square = 0.54					
Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
IQ	5	16078.93	3215.79	56.87	0.0001
Error	247	13966.07	56.54		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	*F*	*p*
Intercept	13.30				
IQ	0.03	0.05	23.20	0.41	0.52
Reading Achievement	0.01	0.01	38.79	0.69	0.41
Music Aptitude	0.38	0.07	1488.17	26.32	0.0001
Tonal Memory	0.43	0.11	869.82	15.38	0.0001
Interest in Music	0.48	0.20	316.05	5.59	0.02

Table H

Stepwise Regression: Best Six

Variable Model for MAT 1

R Square = 0.54

Variable	df	Sum of Squares	Mean Square	F	p
Sex	6	16093.20	2682.20	47.29	0.0001
Error	246	13951.80	56.71		
Total	252	30045.00			

	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	13.77				
IQ	0.03	0.05	16.03	0.28	0.60
Reading Achievement	0.01	0.01	48.15	0.85	0.36
Music Aptitude	0.38	0.07	1494.56	26.35	0.0001
Tonal Memory	0.43	0.11	870.20	15.34	0.0001
Interest in Music	0.48	0.20	323.85	5.71	0.02
Sex	-0.50	0.99	14.28	0.25	0.62

Table I

Stepwise Regression: Best Seven

Variable Model for MAT 1

R Square = 0.54					
Variable	df	Sum of Squares	Mean Square	F	p
Mental Age	7	16094.45	2299.21	40.38	0.0001
Error	245	13950.54	56.94		
Total	252	30045.00			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	13.70				
IQ	0.02	0.09	2.19	0.04	0.84
Reading Achievement	0.01	0.01	47.89	0.84	0.36
Music Aptitude	0.38	0.07	1491.52	26.19	0.0001
Tonal Memory	0.42	0.11	853.79	14.99	0.0001
Interest in Music	0.49	0.21	319.38	5.61	0.02
Sex	-0.49	0.99	13.91	0.24	0.62
Mental Age	0.09	0.64	1.25	0.02	0.88

APPENDIX F

STEPWISE ANALYSIS: MAT 2

Table J

Stepwise Regression: Best Four

Variable Model for MAT 2

R Square = 0.53					
Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
Mathematics Achievement	4	22144.22	5536.05	69.92	0.0001
Error	247	19556.75	79.18		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	*F*	*p*
Intercept	9.11				
Mathematics Achievement	-0.01	0.01	46.58	0.59	0.44
Music Aptitude	0.55	0.09	3214.86	40.60	0.0001
Tonal Memory	0.58	0.12	1883.17	23.78	0.0001
Interest in Music	1.15	0.24	1853.46	23.41	0.0001

Table K

Stepwise Regression: Best Five

Variable Model for MAT 2

R Square = 0.54					
Variable	df	Sum of Squares	Mean Square	F	p
Mental Age	5	22354.21	4470.84	56.85	0.0001
Error	246	19346.76	78.65		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	7.52				
IQ	0.16	0.09	227.26	2.89	0.09
Music Aptitude	0.56	0.09	3064.31	38.96	0.0001
Tonal Memory	0.54	0.12	1424.11	18.11	0.0001
Interest in Music	1.08	0.24	1558.24	19.81	0.0001
Mental Age	-1.36	0.75	255.03	3.24	0.07

Table L

Stepwise Regression: Best Six

Variable Model for MAT 2

R Square = 0.54					
Variable	df	Sum of Squares	Mean Square	F	p
Reading Achievement	6	22488.00	3748.00	47.79	0.0001
Error	245	19212.97	78.42		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	F	p
Intercept	9.59				
IQ	0.21	0.10	348.32	4.44	0.04
Reading Achievement	-0.02	0.02	133.79	1.71	0.19
Music Aptitude	0.56	0.09	3164.37	40.35	0.0001
Tonal Memory	0.57	0.13	1535.06	19.57	0.0001
Interest in Music	1.10	0.24	1619.05	20.65	0.0001
Mental Age	-1.38	0.75	251.15	3.20	0.07

Table M

Stepwise Regression: Best Seven

Variable Model for MAT 2

R Square = 0.54					
Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
Mathematics Achievement	7	22517.11	3216.73	40.91	0.0001
Error	244	19183.86	78.62		
Total	251	41700.96			
	B Value	STD Error	Type II Sum of Squares	*F*	*p*
Intercept	10.50				
IQ	0.22	0.10	370.60	4.71	0.03
Reading Achievement	-0.01	0.02	37.75	0.48	0.49
Mathematics Achievement	-0.01	0.02	29.11	0.31	0.54
Music Aptitude	0.55	0.09	3026.08	38.49	0.0001
Tonal Memory	0.57	0.13	1536.88	19.55	0.0001
Interest in Music	1.10	0.24	1600.29	20.35	0.0001
Mental Age	-1.35	0.75	251.80	3.20	0.07