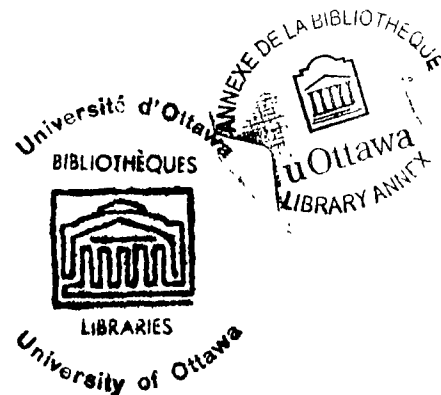


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**A STUDY OF THE RELATIONSHIP BETWEEN
MUSICAL APTITUDE AND INTELLIGENCE**

by Josephine L. Zopf

**Thesis presented to the School of Psychology
and Education of the University of Ottawa as
partial fulfillment of the requirements for
the degree of Doctor of Philosophy.**



Fife Lake, Canada, 1963

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CURRICULUM STUDIORUM

Josephine Lena Miskolcy Zopf was born on January 24, 1917, in Winnipeg, Manitoba. She received her Bachelor of Arts degree from the University of Manitoba in 1938, her Bachelor of Education degree from the University of Manitoba in 1947, and her Master of Education degree from the University of Manitoba in 1957. The title of her thesis was: Musical Aptitude Compared with Intelligence and Achievement in Mathematics.

In 1937, she received the music degree of Associate-ship of the Toronto Conservatory of Music from the University of Toronto.

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INTRODUCTION

This study is concerned with the problem of the interrelationship between musical aptitude and intelligence.

There are at least three possible approaches to the problem of the relation of musical talent to intelligence. One is to run a correlation between the two series, as has been done by many investigators. A second is to see whether or not subjects who make high scores on intelligence tests also rank well on the music tests. The third obvious method is to ascertain whether musically gifted students score better than average on the intelligence tests. Because the reporter plans to consider the last two approaches, the problem is stated in the form of two questions: (1) Is high musical talent found among the intellectually gifted? (2) Does intellectual talent accompany musical talent?

A subordinate problem of interest is to discover whether the intellectual students show a higher correlation between factors than the musical students show.

In investigating the possible relationships between musical talent and intelligence in this study, factors of intelligence were compared to factors of music. It is hoped that the findings of this study may in some degree contribute some knowledge of the correlates of musical talent. Such knowledge would be of great importance not

only to the music psychologist but also to the music educator.

To locate and recognize the difference in the kinds of talent is the need of music education today. Few people are aware that such enormous differences in musical gifts exist.

Although there is a large body of research material which bears upon the problem of the relationship between musical aptitude and intelligence, psychology is in no position to offer a complete and assured reply and further research is needed.

The first portion of this thesis is concerned with an explanation of certain key terms and existing musical theories, a review of the literature, and a statement of the hypothesis. Chapter II furnishes a description of the experimental design of the project. The tools of the experiment are presented. Due consideration of the sample population precedes the actual description of the method. The third chapter is devoted to the presentation and discussion of the results obtained. Finally, a summary of the conclusions and an appreciation of the importance of the research is attempted. This final section is followed by the bibliography and the appendix. In the appendix, is found the thesis abstract and a sampling of the raw data as well as copies of the test forms used.

CHAPTER I

REVIEW OF THE LITERATURE

The first chapter of this thesis is devoted mainly to a review of the literature. However, before proceeding to any discussion of the status of the question in the literature, it seemed wise to introduce two items, namely, (1) the definition of certain key terms, and (2) a description of various music theories. The review of the literature is then followed by a statement of the hypothesis.

1. Definition of Certain Key Terms.

The terms for consideration are intelligence and aptitude. When the term intelligence is employed it will refer to the individual's intelligence as measured by the so-called general intelligence test or by the factorial intelligence test.

The newer multi-factor intelligence tests have split up the measure of general intelligence into special measures of its parts. Such instruments yield, not a single, over-all measure such as an IQ, but a set of scores of different aptitudes. Thurstone¹ has differentiated

¹ L. L. Thurstone and Thelma Gwinn Thurstone, Examiner Manual for the Science Research Associates Primary Mental Abilities, Intermediate, Ages 11 to 17, Chicago, Science Research Associates, Inc., 1949, p. 1-2.

intelligence into a number of special aptitudes, such as verbal meaning, number, reasoning, space, word-fluency, and the like.

For the purpose of this study, intelligence is defined as that set of factors or traits which is measured by the Science Research Associates Primary Mental Abilities Tests.

The next term to consider is aptitude. The term aptitude is by no means used clearly and consistently in studies. The word aptitude has several connotations. Sometimes it is synonymous with talent; other times, while talent indicates capacities far above average in a special field of human activity, aptitude indicates fitness for performance or native latent endowment.

Seashore² uses the word talent in place of aptitude and the word is used to denote a combination of traits. He says:

Musical talent is not a single talent; it is a hierarchy of talents, many of which are entirely independent of one another. (...) Musical talent is a gift bestowed very unequally upon individuals. Not only is the gift of music inborn, but it is inborn in specific types.³

He broke down musical aptitude into what he considered its components, such as the sense of pitch, time, etc. Certain

² Carl Emil Seashore, The Psychology of Musical Talent, New York, Silver, Burdett & Co., 1919, xvi-288 p.

³ Carl Emil Seashore, op. cit., p. 6.

musical talents lend themselves to identification and measurement. The results indicate the amount of musical endowment possessed by the person, or the total index of an individual's innate capacity.

Musical aptitude, for the purpose of this investigation, is operationally defined in terms of scores made on Seashore tests for pitch and memory and on the Drake tests for musical memory and rhythm.

2. Description of Music Theories.

Because of the important part the musical theories have played in the different approaches used in the studies, a brief description of these theories seems almost a necessity before any related investigations are considered.

One of the more important problems in the field of psychology of music is that which deals with the nature of what Seashore has termed the "musical mind". Three theories have evolved from the several approaches to this problem. They are identified as (1) the multi-factor or integrative theory of Seashore⁴, (2) the 'omnibus' theory of Mursell⁵, and (3) the compromise theory of Lowery⁶.

⁴ Carl Emil Seashore, op. cit., xvi-288 p.

⁵ James L. Mursell, The Psychology of Music, New York, W. W. Norton, 1937, 389 p.

⁶ H. Lowery, "On the Integrative Theory of Musical Talent", Journal of Musicology, Vol. 2, No. 1, May, 1940, p. 1-15.

The integrative theory is fundamentally concerned with the assessment of a hierarchy of talents, often called discrete sensory skills. Seashore⁷ considers musicality to consist of a large number of isolated, limited traits rather than to appear as a single 'omnibus factor' in the musical temperament. This integrative theory which attempts to analyze musical talent into factors or parts is also accepted by Drake⁸. Kwalwasser⁹, too, supports the Seashore tests and points out the great need for further research in the science of music pedagogy. He states:

To encourage testing and measuring is to encourage a problem solving attitude on the part of the music teaching profession; to discourage testing and measuring is to return to a state of empirical chaos and ignorance. Let there be more light.¹⁰

Chief criticism of this movement has been made by James L. Mursell¹¹ and followers, who believe that musical talent is neither innate nor can it be measured in isolated capacities. There is instead a total reaction of the total personality to a musical situation. The ability or attribute is a perceptual rather than a sensory one. This theory

7 Carl Emil Seashore, op. cit., xvi-288 p.

8 Raleigh M. Drake, "What is Musical Talent?", Journal of Musicology, Vol. 1, No. 2, 1939, p. 9-13.

9 J. Kwalwasser, "From the Realm of Guess into the Realm of Reasonable Certainty", Music Educators Journal, Vol. 24, 1938, p. 16-17.

10 J. Kwalwasser, op. cit., p. 17.

11 James L. Mursell, op. cit., 389 p.

takes into account the individual as a part of the total musical situation and his interaction with it. Mursell further states that "Musicality has both an intellectual and an emotional side, and an individual highly endowed in respect of one may be defective in respect of the other".¹²

This group accepts the Seashore tests as having merit but believes that the tests are inadequate, without supplementation, as an instrument of musical prognosis.

The compromise theory of Lowery¹³ attempts to reconcile certain aspects of the preceding ones. In his explanation, the distinction made by Lowery is that the two theories refer to different levels of training or stages of development of the musical mind. Upon this basis he concludes that the integrative theory of Seashore and the omnibus theory of Mursell are mutually exclusive. Thus, from Lowery's position, a rapprochement between them is established upon the basis of their usage with two categories of persons, persons of different levels of musical development.

The description of the theories just given will serve as a background against which the various related studies can be set.

¹² James L. Mursell, op. cit., p. 322.

¹³ H. Lowery, op. cit., p. 1-15.

3. Review of the Literature.

There have been many studies made to determine the relationship between musical ability and intelligence. From a survey of studies, the reporter finds a divergent viewpoint. The literature roughly falls into two divisions. First, there are the studies which report little or no correlation between intelligence and musical talent. Next, there are studies which indicate a close relationship between intelligence and musicality. The early American studies were prevailingly of the first type, while the European studies consistently upheld the latter viewpoint. However, several more recent American studies have joined the ranks of the Europeans.

The summaries of research studies which follow point up the two distinct approaches to the study of the nature of musical talent. In the American studies alone, it should be noted that the results are contradictory. Many studies report low but positive correlation while others indicate a fairly close relationship.

In the main, American studies have chiefly been concerned with the relationship as between the scores of the Seashore and Kwalwasser tests and various standard general intelligence tests. These music tests have used an atomistic approach to the problem of musical talent,

and have utilized selected elements of musical talent, primarily of an acoustical nature. The underlying assumptions of this approach are: (1) that musical talent is a composite of many separate abilities, and (2) that some of these abilities can be isolated from musical contexts and measured specifically.

In the majority of studies using this approach, low correlations have been reported. This viewpoint is confirmed by the study which follows. In her study, Hollingworth¹⁴ investigated the capacities of a group of children whose intelligence quotients ran above 135. This very superior group of children showed no particular outstanding performance on the Seashore battery. Her forty-nine "intellectually gifted" child subjects gave mean percentiles on fifth grade norms of: pitch 47, intensity 50, time 50, consonance 48, and memory 52.

Mursell¹⁵ was of the opinion that this important investigation conducted by Leta Hollingworth¹⁶ confirmed the viewpoint of a slight relationship between intelligence

¹⁴ Leta Hollingworth, "Musical Sensitivity of Children Who Test above 135 IQ", Journal of Educational Psychology, Vol. 17, 1926, p. 95-109.

¹⁵ James L. Mursell, "Intelligence and Musicality", Education, Vol. 59, May, 1939, p. 559.

¹⁶ Leta Hollingworth, op. cit., p. 95-109.

and musicality. In fact, both Drake¹⁷ and Mursell¹⁸ have pondered this relationship between musical ability and intelligence and have stated that, on the whole, low correlations have been reported between scores on various standard intelligence tests and scores on the Seashore Measures of Musical Talents and the Kwalwasser-Dykema Music Tests, two of the most frequently used music tests.

However, such low results have not been obtained without exception. The next group of studies is concerned with the investigations which support the opposite point of view and report a fairly close correlation. Studies in which both the Seashore and the Kwalwasser-Dykema tests were used, have reported higher correlations.

A number of studies which employed the Seashore tests are reviewed briefly now. The first two investigations of importance were those by Highsmith and Gray and Bingham. In a study of fifty-nine girls from the School of Music of North Carolina College for Women, Highsmith¹⁹ ascertained the relationship between the Seashore battery

¹⁷ Raleigh M. Drake, "The Relation of Musical Talent to Intelligence and Success in School", Journal of Musicology, Vol. 2, No. 1, 1940, p. 38-44.

¹⁸ James L. Mursell, op. cit., p. 559-62.

¹⁹ J. A. Highsmith, "Selecting Musical Talent", Journal of Applied Psychology, Vol. 13, October, 1929, p. 486-93.

and a combined intelligence rating made from two standard intelligence tests. He reported a correlation of .58, p.e. .06 between Seashore pitch and the intelligence rating.

Then, in the study by Gray and Bingham²⁰, the Seashore scores of the five tests of their grades 6, 7, and 8 subjects were added together to create a total musical score. A high relative correlation was found to exist between the total music score and the Otis Group Test. Correlations ranged from .53 to .70.

In connection with a very ambitious and important testing program at the Eastman School over a period of ten years, Hazel Stanton²¹ found a distinct relationship between Seashore Measures and the Iowa Comprehensive Test but did not report the correlations obtained.

Also, Ross²² reported on 1541 students from grades five to twelve. Low positive correlations, r's from .06 to .25 were found between the Seashore tests and the Terman Mental Ability Test. However, he also found that pupils

20 C. T. Gray and C. W. Bingham, "A Comparison of Certain Phases of Musical Ability of Colored and White Public School Pupils", Journal of Educational Psychology, Vol. 20, 1929, p. 501-6.

21 H. M. Stanton, "Measurement of Musical Talent, The Eastman Experiment", University of Iowa Studies, Studies in the Psychology of Music, Vol. 2, University, Iowa City, 1935, p. 1-141.

22 V. R. Ross, "Relationships between Intelligence, Scholastic Achievement, and Musical Talent", Journal of Juvenile Research, Vol. 20, 1936, p. 47-64.

who possessed superior musical ability were found to be superior to the general population in intelligence.

Finally, more recently, Cooley²³ reported a study in which he used 180 undergraduate music students at Michigan State College. Tests administered were the Seashore Measures and the ACE Psychological Examination. His conclusion was that there is evidence that high intelligence, high reading ability, as well as superior performance on the Seashore Tests, tend to go with musicality.

The studies which have just been under consideration are those which reported a higher relationship between intelligence and musicality when the Seashore Measures were used. Some of these studies have been examined and criticized by different writers. The investigations by Highsmith and Gray and Bingham conflicted seriously with the results obtained by Drake²⁴.

Drake stated that the correlation of .58 between Seashore pitch and a standard intelligence test reported by Highsmith is higher than any of the coefficients in the literature. Because almost all of the other correlations

²³ J. C. Cooley, A Study of Relationships between Certain Mental and Personality Traits and Ratings of Musical Abilities, Ed. D. thesis, Michigan State College, 1952, 187 p.

²⁴ Raleigh M. Drake, op. cit., p. 38-44.

reported in this same study are higher than those found by other investigations, he suggested that the correlation coefficient is spurious to some degree. He continued:

Perhaps there was something peculiar to the group employed: there may have been an extremely wide range of ability in music or intelligence, or for both. At any rate, this is not a typical result.²⁵

Drake also offered a partial explanation for the high correlation reported by Gray and Bingham. He stated that:

One reason for these relatively high correlations is the fact that when several tests are added together there is a tendency to bring out anything which is common to them as a group. This factor which is common to all tests is intelligence (Spearman's *g*), and since the correlation is with a test of intelligence, there is an inflation of the true relationship.²⁶

Then, too, if the bright pupils pay attention, understand the directions, and try to do their best on the test, while the poorer pupils do not understand or try, there will be a further inflation of the correlations. He admitted, nevertheless, that there is no direct evidence reported of this being the case, but felt that it was very probable. He assumed, also, that in the experimental group the colored children would constitute the poorer pupils and the white

25 Raleigh M. Drake, op. cit., p. 42.

26 Raleigh M. Drake, op. cit., p. 41.

children would tend to be the brighter pupils. When two distinctly different groups are averaged and the range of ability is great, there is considerable reason for believing that the intelligence factor would play considerable part in the taking of the tests. The writer points out that the correlations of the colored boys and girls are rather high considering the fact that Drake suggested that they would probably constitute the poorer pupils.

Mursell²⁷ has also made statements regarding the investigation by Grey and Bingham. He was of the opinion that in this study the factor of racial purity was not given adequate consideration and that there was a sampling problem. He pointed out the fact that in the investigation a test which was standardized for a given ethnic group was applied to another group. Consequently, the basis of comparison may not be valid.

The next study to be considered is the important one of Hazel Stanton. Regarding this experiment in which the correlations obtained were not reported Mursell²⁸ remarked: "These findings are undoubtedly significant and of practical value. (...) and it is clear that the battery possesses considerable predictive value."²⁹

27 James L. Mursell, The Psychology of Music, New York, W. W. Norton, 1937, p. 240-41.

28 James L. Mursell, op. cit., p. 298-99.

29 James L. Mursell, op. cit., p. 299.

Even if criticisms have been levelled at some of the studies by eminent men it is evident that there is still considerable room for doubt.

The foregoing studies reported on the higher results which were obtained when using the Seashore Tests. A similar trend was also shown by Dykema and Beckham, when the Kwalwasser-Dykema Tests were employed.

Dykema³⁰ conducted a study with 5840 European children, aged nine to eighteen. He reported that there was a decided tendency for brighter children to rank higher than normal children of their age. These brighter children sometimes even surpass those who are older. No correlations were given in the report.

In his study, Beckham³¹ was concerned with the musical ability of 100 superior negro children, aged eight to eleven. He found that the number of intellectually superior children above the fiftieth percentile on the Kwalwasser-Dykema battery to be greater than the number of non-selected children. In another comparison he found that the thirty musically superior children who were picked by

³⁰ Peter W. Dykema, "An International Study of Musical Talent", Music Educators National Conference, 30th Yearbook, 1937, p. 94-96.

³¹ Albert Sidney Beckham, "Study of Social Background and Musical Ability of Superior Negro Children", Journal of Applied Psychology, Vol. 26, April, 1942, p. 210-217.

teachers outranked the intellectually superior on the music scores.

More recently, there is the report of Antrim³² in which he pointed out that "we came upon a body of evidence that goes a long way to prove the point; namely, that high music talent and high IQ are blood relations".³³ He cited two studies which lend definite support to this statement. The first finding which covered a period of thirty years, came from Magdalen College, Oxford University. He stated that, while only ten per cent of the students studied music, the music students won seventy-five per cent of all prizes and scholarships offered by the college. He also stated that the IQ's for music students at New York City High School of Music and Arts averaged eleven per cent higher than the general level for students in other New York Schools.

The preponderant mass of evidence in the American studies is that there is little or no relationship on music talent tests and on tests of general intelligence. But Mursell³⁴ feels that the contrary findings which have been

³² D. K. Antrim, "Do Musical Talents Have Higher Intelligence?", Paideia, Vol. 63, 1945, p. 127-128.

³³ D. K. Antrim, op. cit., p. 127.

³⁴ James L. Mursell, "Intelligence and Musicality", Education, May, 1939, p. 560.

reported cannot be ignored. In fact, these contradictory findings of the American investigators seem even more striking when the work of the European investigators is considered.

Contrasting the work of the American research workers is the work of the European researchers.³⁵ European studies, and more particularly those in Russia and Germany, indicate consistently a fairly close relationship between intelligence and musicality. Here, for the most part, the approach to the problem of musical talent has been that of the gestalt psychologist using musical criteria as a basis for prediction. Here, the underlying assumption is: musical talent is expressed by the whole personality and therefore cannot be ascertained by dividing the musical personality into fragments to be measured individually, but must be measured as a unit functioning in a unified situation.

Thus, in the European studies, criteria of musicality other than the tests are used. Mursell³⁶ has written an excellent summary of several German studies of particular pertinence. He points out that Koester, the Pannenberg, Miller and others are unanimous in finding

³⁵ James L. Mursell, op. cit., p. 559-62.
³⁶ James L. Mursell, op. cit., p. 560.

that musicality and intelligence go together.

Koester³⁷ reported a study in which he had teachers divide 3000 pupils from primary, intermediate, and secondary schools into six groups on intelligence and on musical talent. In the two highest groups on musical talent it was found that: 40% were in the highest two for intelligence, 31% in third, 26% in fourth, and 23% in fifth and sixth. In the two lowest groups on musicality, it was found that: 10% were in the two highest for intelligence, 14% in third, 31% in fourth, and 28% in fifth and sixth.

Then, there is the work of the Fannenburgs and of Miller. The Fannenburgs³⁸, in their study, investigated the abilities of 423 musical adults and of 494 highly musical children between the ages of twelve to eighteen. They reported that highly musical individuals exhibited superiority in linguistic, artistic, and cultural achievements.

³⁷ Hermann L. Koester, "Über das Verhältnis der intellektuellen Begabung zur musikalischen, zeichnerischen, und technischen Begabung", Zeitschrift für pädagogische Psychologie, Vol. 31, 1930, p. 399-403.

³⁸ H. J. and W. A. Fannenburg, "Die Psychologie des Musikers", Zeitschrift für Psychologie, Vol. 73, 1915, p. 91-136, as found in James L. Mursell, The Psychology of Music, New York, Norton & Co., 1937, p. 338.

Miller³⁹, in a ten year study of 26 students found that all round talent usually includes musical talent and that persons who possess musical talent usually have good general ability, and those with poor general talent are seldom talented in music.

Finally, Haeker and Liehen⁴⁰ reported similar results for large populations.

As has been seen, the European studies indicate a close relationship between intelligence and musicality. Several opinions have also been expressed about the European studies. In commenting on several of the studies, Drake⁴¹ stated that the high relationship reported by Haeker and Liehen, Koester, Miller, and the Pannenburgs was probably due to the "halo effect" in the estimates of teachers regarding musicality, or in assigning grades in music.

With regard to the study by the Pannenburgs, Mursell⁴² made the statement which follows. He admitted:

³⁹ Richard Miller, "Über musikalische Begabung und ihre Beziehung zu sonstigen Anlagen", Zeitschrift für Psychologie, Vol. 97, 1925, p. 191-214, as found in James L. Mursell, op. cit., p. 338.

⁴⁰ V. Haeker and E. Liehen, "Über die Erblichkeit der musikalischen Begabung", Zeitschrift für Psychologie, Vol. 88, 1921, p. 265-307, as found in Mursell, op. cit., p. 338.

⁴¹ Raleigh M. Drake, "The Relation of Musical Talent to Intelligence and Success in School", Journal of Musicology, Vol. 2, No. 1, 1940, p. 41.

⁴² James L. Mursell, op. cit., p. 338.

"No intelligence test was run, but it is fair to assume that, if it had been, this group would have shown up advantageously".⁴³ Also, his comment about the European studies is worthy of considerable thought. He said:

It is true that on the whole the work done in Germany and Russia is not in our American fashion of making extensive use of standardized tests. But certainly this is no reason for refusing to heed it. No one who studies it with care can avoid the conclusion that it is very careful and competent, and that its findings are worthy of all respect.⁴⁴

The foregoing statement by Mursell compels one to take notice of the work of the European researchers even though one is aware that the methods used were different.

From the foregoing presentation of studies, it can be seen that in the search for relationships between musicality and intelligence, the findings have been contradictory. How can these seemingly flat contradictions be explained? Mursell⁴⁵ believes this incongruity to be the result of divergent concepts of musicality. The American concept involves measurement of sensory capacities, while the Europeans appraise musicality by functional criteria, as behavior in musical situations.

⁴³ James L. Mursell, op. cit., p. 338.

⁴⁴ James L. Mursell, "Intelligence and Musicality", Education, Vol. 59, May, 1939, p. 561.

⁴⁵ James L. Mursell, op. cit., p. 559-562.

Mursell's explanation gives a partial answer. However, neither of the two bodies of research can be dismissed from consideration. The fact remains that the relationship has not been settled. The reporter agrees with Mursell when he says:

Results out of keeping with an accepted generalization always have a peculiar importance, because they indicate that a problem still exists, and that research designed to clear up the conflict is decidedly in order.⁴⁶

Because the question of the relationship between musicality and intelligence has not been settled, research along this line must continue. Something is already known of the nature of intelligence and aptitudes of various kinds can be measured. What factors or combination of factors are required for the musical personality?

This study will attempt to explore the relationship between a group of human traits. These traits are certain elements of musical talent and certain factors of intelligence.

From a search of the literature, it was noted that in the comparisons made, the intelligence rating was in one of the following three forms: (1) a composite IQ score for a standard test, (2) a combined rating made from the scores of two standard tests, or (3) a score which consisted of

⁴⁶ James L. Mursell, op. cit., p. 560.

three parts, such as language, non-language, and a total IQ. At the present moment, a factorial intelligence test which is composed of five independent scores rather than a single measure, can be used. There may be no relationship between music factors and a total IQ score and still be a very close one between musical factors and certain intelligence factors. Is it not possible that these elemental components of intelligence are related to the factors of the music tests? This is precisely the relationship which the reporter plans to investigate.

In a previous study⁴⁷ using an unselected group, a significant relationship was discovered between musical factors of Seashore Memory and Pitch and Drake Rhythm and the intellectual factors of Verbal Meaning and Reasoning. A greater relationship was expected to emerge when two special groups were utilized.

4. Statement of the Hypothesis.

The hypothesis stated in the null form is:

(a) There is no relationship between the factors, tonal memory and pitch, in the Seashore battery and verbal

⁴⁷ Josephine Lena Miskolcy, Musical Aptitude Compared with Intelligence and Achievement in Mathematics, unpublished ... Ed. thesis, University of Manitoba, 1957, vii-85 p.

meaning, space, reasoning, number, and word-fluency in the Science Research Associates Mental Abilities Tests.

(b) There is no relationship between the factors, memory and rhythm, in the Drake tests and verbal meaning, space, reasoning, number, and word-fluency in the Science Research Associates Primary Mental Abilities Tests.

The foregoing chapter has attempted to provide a setting for the thesis by presenting a definition of key terms, a discussion of musical theories, a review of the literature, and also a statement of the hypothesis.

The following chapters constitute a record of the design, procedure, results, and conclusions for an investigation of relationships between musical aptitude and intelligence.

CHAPTER II

EXPERIMENTAL DESIGN

This chapter presents the procedures involved in conducting an experiment to test the hypothesis proposed in the first chapter. A brief description of the tools of the experiment is given. The sample population is then described. This is followed by a description of the method of the experiment which includes a note on the testing rooms, supplies, sequence, time, and treatment of data.

1. The Tools of the Experiment.

In order to test the hypothesis, five standardized tests were selected and administered to three groups of students. The musical aptitude factors were measured by (1) the Seashore Measures of Musical Talents for the sense of pitch and for the sense of tonal memory, and (2) by the Drake Musical Aptitude Tests for musical memory and rhythm. The intelligence factors, namely, verbal meaning, space, reasoning, number, and word-fluency, were measured by the Science Research Associates Primary Mental Abilities Tests.

Justification of the mental abilities tests or the battery of music aptitude tests used in this study was not considered necessary since their construction was not involved. However, a brief description of the music aptitude

tests and a discussion of their significance as expressed by their originators seemed pertinent to the problem.

The Measures of Musical Talents by Dr. Carl Seashore¹ of the Iowa State University were chosen because these tests are still the foremost tests of this type. This test, Measures of Musical Talents, is one of the oldest of musical talent tests and is probably best known. Dr. Seashore was a pioneer in this field. His tests first appeared in 1919. The fact that these measures grew by experimental procedure over a long period of time puts them in contrast with many tests today which are made almost overnight. Because of their experimental foundation and their basic nature the Seashore tests have been long lived. The Measures of Musical Talents are of such a nature that they can be given to groups, to children and adults, to the musically untrained as well as to the musically trained. They are measures of capacities and not achievement.

These measures as now recorded on phonograph records have reached probably the peak of technical excellence in so far as presentation of stimuli are concerned. The whole series takes about an hour. Full directions for administering and scoring the tests are available. The

¹ Carl E. Seashore, et al., Seashore Measures of Musical Talents, Revised Manual, New York, The Psychological Corporation, 1956, 11p.

instructions are short, clear, and, except for the practice items, standardized. Answer sheets are available for machine or hand scoring. Practice exercises are taken off the actual test record. This procedure has the disadvantage that if they are taken from a place towards the middle of the record, there is some possibility of damage to the record, while if they are taken at the beginning, they may help the candidate to do the first few items.

The two Seashore Tests used in this investigation are as follows:

(1) Memory test. In this test a number of consecutive notes which form no particular melody are sounded. Then these notes are played again, but in the second playing one note is changed. The candidate is asked to give the number of the altered note.

(2) Pitch test. In this test two notes are sounded consecutively. The candidate is required to say whether the second note is lower or higher than the first note.

Seashore² regards all of his measures of musical talent as dealing with basic elements which function in all music. He considers pitch discriminations to be one of the most essential capacities for musical success and points

² Carl E. Seashore, The Psychology of Musical Talent, New York, Silver, Burdett & Co., 1919, xvi-288 p.

out that a good sense of pitch, in itself, is not predictive of musical success but a poor sense of pitch is a certain sign of difficulty or failure.

Seashore believes that musical memory is an inherited talent which varies greatly with individuals but is capable of considerable improvement with training. The Seashore test of tonal memory measures memory for isolated tones since the test items consist of patterns of discrete, unrelated tones in spans of various lengths.

The second music test selected and used in the study was the Drake Musical Aptitude Tests by Raleigh M. Drake³. These tests which were copyrighted in 1954 do not as yet possess the reputation of the old Seashore tests. In years to come they will have the opportunity of proving their worth.

The Drake tests measure two critical aptitudes; musical memory and rhythm. They help to identify genuine or inherent musical aptitude. Drake himself, says; "These data indicate that the tests are measures of "pure" aptitude, and not the measures of achievement, intelligence, age, or any other spurious factors that often influence scores on so-called aptitude tests."⁴

³ Raleigh M. Drake, Manual for the Drake Musical Aptitude Tests, Second Edition, Chicago, Science Research Associates, 1957, 32 p.

⁴ Raleigh M. Drake, op. cit., p. 19,

These measures are recorded on one long playing microgroove phonograph record. This one record includes the test items for the two Drake tests and all practice exercises. The tests can be easily administered in two forty-minute sessions. Complete directions for administering, scoring, and interpreting test results are available. Quick scoring pads are available for the tests. Then, too, practice exercises are given and these may be replayed as often as necessary.

The Musical Memory test consists of original two-bar melodies which are played on the piano. The student has to remember these melodies and then compare them to possible changes with respect to time, key, or note. The two forms of the Musical Memory test are approximately equal.

In the case of the Rhythm test, however, the two forms are not equivalent except in a general way. Form A measures rhythm in a simple form. A tempo is established and then faded out. The subject continues with the tempo until he is told to stop. In the Form B, the student is required to maintain a consistent beat in spite of a second distracting tempo. Thus, Form B is much more difficult than Form A.

To date, most tests of rhythm have assumed that the perception of difference and sameness between two series of

beats is an adequate measure of rhythm. Drake feels that such a task can be performed almost as well by the unrhythmical as by the rhythmical person. Drake's Rhythm test has been constructed on the principle that the performer must not only feel rhythm strongly but that he must also be able to maintain a set tempo despite distractions.

Drake described musical aptitude in the following way: "The best evidence at the present time is that "musical aptitude" represents a cluster of three factors - Musical Memory, Rhythm, and, to a lesser extent, Pitch Discrimination."⁵ Drake's test for Musical Memory, unlike its counterpart in Seashore Measures, is a test of memory for whole musical phrases in which tones form meaningful melodic patterns. Although this is not the only factor in musical talent, Drake states that "it appears to be an aptitude without which no musician can achieve more than mediocre success."⁶ The success of the musician is dependent upon the degree to which he possesses these two abilities, namely, Musical Memory and Rhythm.

This short discussion of the Seashore Measures of Musical Talents and the Drake Musical Aptitude Tests is now followed by a description of the sample population.

⁵ Raleigh M. Drake, op. cit., p. 18.

⁶ Raleigh M. Drake, op. cit., p. 4.

2. The Sample Population.

The next part of this chapter describes the groups of children utilized in the study. The groups in the study consisted of children enrolled in the Grade VII classes in the schools of the city of Winnipeg, Manitoba, during the school year 1958-59. All students in the schools were exposed to a similar program, were under the same superintendent and school board, and were issued the same bulletins, directions, rules, and examinations.

Three groups of children were used in this study. These groups were: (1) intellectual, (2) musical, and (3) unselected. Because each group was obtained in a different way, each group will be described separately.

The first group for consideration was the intellectual group. In order to clarify the description of the children used in this group, it seems necessary to introduce at this point a brief report on the experiment⁷ being conducted in the Winnipeg schools.

In 1954, a major work program for children of superior ability was begun with three classes, one in each end of the city. The program was carried on and for the school

⁷ Superintendent's Department, School District of Winnipeg, No. 1, Report on Major Work Classes in Winnipeg Public Schools, November, 1958, 17 p.

year 1958-59, twenty-four major work classes, ranging from Grades IV to IX, were in session. It should be noted, however, that only a small number of the city schools have benefited so far by this experimental program.

The pupils for this special program are selected in Grade III, when all pupils from the school with an Intelligence Quotient of more than 120 are reported to the school administration. The Child Guidance Clinic then makes further tests and those students with IQ scores of 125 and above and the students whom the teachers and psychologists think will do well are selected for the classes. After a child has been selected for placement in a major work class, parental consent is sought by the class teacher who visits each family.

Each class which is organized serves one or more schools in its area of the city, and is located in a local school so that the children will not be isolated from the others of their age. They participate in all activities of the school. There is no evidence that they consider themselves to be different from other children.

For the school year 1958-59 there were five Grade VII major work classes in the city. The writer tested three of these classes which consisted of nineteen, twenty-four, and twenty-eight students respectively, and obtained a total of seventy-one students. On the Dominion Test, the IQ's of

the intellectual group used in the experiment ranged from 120 to 164. Only fifteen scores were below 130. The average IQ score for the group is 139.49. It is evident that this is a highly selected group in general ability. The three classes which made up the intellectual group were selected by an unbiased school administrator. This official with knowledge of the complete experimental program drew classes from different sections of the city so that the sample would contain children with different types of cultural background.

The second group needed for the study was the musical group. The subjects in this group were students who were picked by their music teachers as being superior in musical achievement. Each music teacher in a school was asked to select four or five of the most outstanding musical students from his or her Grade VII music classes with the following considerations in mind: (a) the student was enrolled in instrumental or vocal classes or did solo work, (b) the student showed an interest in music, and (c) the student was taking music lessons. The selection of the students in this group depended to a certain extent upon the teachers' judgment of the student's ability and achievement. Out of a possible twenty schools in the city with junior high classes, sixty-eight students were obtained from fourteen schools.

Even though each music teacher had been asked for the same number of students, the number of selected students from the schools varied as follows: four, three, three, four, five, sixteen, two, six, four, seven, six, six, one, and one. This variation might be due to various reasons: (1) the number of Grade VII classes in each school varied, (2) the teacher felt that either there weren't four or five musical students in his classes or that there were more than four or five which had to be reported. Schools from which these children came covered each section of the city.

The unselected group was the third group of students required for the study. This group was composed of all the Grade VII children enrolled in one school. This larger group which was composed of five classes was taken from the Sisler High School. Children who were not able to attend the tests at the times arranged for their class were given one or more opportunities to take the tests at a later date. When all records were tabulated, it was found that 143 subjects had been tested. However, three of these students were dropped. Two students were dropped on account of age. The writer considered these two pupils, aged sixteen and seventeen, as outstandingly different. The third student was dropped because this student was unwilling to cooperate in taking the tests and had omitted quite a few of the answers on the Drake Rhythm test. For this

study the large group of unselected students numbered 140.

The final sample, then, included seventy-one students in the intellectual group, sixty-eight students in the musical group, and one hundred and forty students in the unselected group.

3. The Method of the Experiment.

The description of the method of the experiment will include a note on each of the following items: testing rooms, supplies for the test program, sequence of tests, time for administration of tests, test procedure, and treatment of data.

Testing rooms. - Because the students for both the musical and intellectual groups were taken from schools located in different sections of the city, it was impossible to use the same rooms for testing. The examiner went from school to school and administered the test to groups of varying sizes. In all cases the principals of the schools were most helpful and cooperative, and the examiner was given a room where the least noise would be heard. In a few schools it was discovered that in order to keep the testing room free from disturbing sounds, the principal had issued a special room allocation to the other classes in the school for the entire morning session.

Light, ventilation, and temperature were favorable for efficient working conditions. Adequate seating equipment was provided for the testees.

It should be noted that in the case of the unselected group, it was possible to use the same room for testing all individuals.

Supplies for the test program. - Test supplies included test booklets for the PMA Tests, hand scoring carbon answer pads for the PMA Tests, answer sheets for the music tests, manuals of instructions for each of the tests, paper for scribbling purposes, a supply of pencils and erasers, and finally the two records on which were recorded the Seashore Measures and the Drake Tests. The two music records were new and were purchased for the study.

For every test situation the examiner used the same portable phonograph and carried the same watch complete with second hand.

Sequence of tests. - Before any testing for the study was begun, the writer administered the selected battery to a group of five Grade VIII students. The reactions of this group were noted. As a result of this testing the order of the tests was changed and a ten minute break was given at the half-way mark in an attempt to overcome, partially at least, the element of fatigue.

The order in which the tests were presented in the study was as follows: Seashore Pitch, Seashore Memory, Drake Rhythm, Form A, PMA Tests, Drake Musical Memory, Form A, Drake Rhythm, Form B, and Drake Musical Memory, Form B. The Seashore test of pitch is advantageous for a first test because it arouses interest, is elementary in content, and is stimulating to the ear.

Time for administration of tests. - The approximate time necessary for the presentation of each test, varying for the size of the group tested, was seven minutes for Seashore Pitch, seven minutes for Seashore Memory, twenty minutes for Drake Rhythm, Form A, sixty-five minutes for the PMA Tests, sixteen minutes for Drake Memory, Form A, twelve minutes for Drake Rhythm, Form B, and ten minutes for Drake Musical Memory, Form B. The total testing time, however, varied from two hours, seventeen minutes to three hours.

All groups with only one exception were tested in the morning between the hours of nine and twelve. The exceptional case mentioned was one group of four students who were tested in an afternoon session in order to comply with the principal's wishes.

Test procedures. - Pencils and erasers were placed on the desks before the arrival of the students. As soon as the pupils were seated, the first answer sheet was

distributed. Directions for the tests were brief but definite. Whenever necessary, individual assistance was given. As soon as the test proceeded the room was perfectly quiet.

Before each music test, practice examples were given. Besides the practice exercises from the records for the Drake Musical Memory Test, the examiner sang illustrative phrases to help the students understand the directions. When once the music test was in progress no further directions were necessary. At the completion of the test, test papers were immediately collected.

When the FMA Tests were administered, the examiner followed the directions in the manual closely and timed each section carefully.

The intelligence and music test forms, as submitted to the pupils, are herewith attached in the Appendix.

The testing was done during the months of March, April, and May. The tests were administered at approximately the same time during the year so that the constant interval in school development and age would be kept. The testing was done, for the most part, during regular school hours. All tests were given by the same person.

At the close of the testing program the author marked the test papers. The results obtained for all students used in the study were compiled in tabular form.

The raw scores obtained by the Intellectual Group on all tests are found in Table VIII, the raw scores obtained by the Musical Group on all tests are found in Table IX, and finally, the raw scores obtained by the Unselected Group on all the tests are found in Table X. These tables appear in the Appendix, pages 76, 78, and 80.

Treatment of data.- After the above variables or scores were obtained, it was possible to carry forward the purpose of the problem which was to determine the relation, if any, of the scores received on these musical talent tests to the scores on the mental tests. For statistical treatment of data in this study, extensive use was made of a most appropriate technique, the Product-moment coefficient of correlation.

For each group of students the results of the music tests were correlated with the scores on the different intelligence factors. The raw scores from the tests were used to calculate the coefficients of correlation. The formula⁸ for the calculation of the coefficient of correlation used in this study is:

$$r = \frac{NEXY - (EX)(EY)}{\sqrt{[NEX^2 - (EX)^2][NEY^2 - (EY)^2]}}$$

⁸ J. P. Guilford, Fundamental Statistics in Psychology and Education, New York, McGraw-Hillbrook Co., 1956, p. 140.

The different correlations were computed through use of a calculating machine. In all, sixty correlations were calculated.

The correlations obtained were treated in two ways. First, the correlations for the unselected group were tested for significance by use of the t test. For purposes of this thesis a correlation will be accepted as significant at the five percent or less than five percent level. That is to say, the chances are only five in one hundred that the observed correlation could have arisen by chance alone. Further, a significance level of one percent indicates that the chances are only one in one hundred that the observed correlation has arisen by chance alone. To be significant the ratio for the unselected group should be greater than 2.58 at the one percent level or 1.96 at the five percent level.

Secondly, the correlations for the intellectual and musical groups were corrected for restriction of range. The size of a coefficient of correlation is very much affected by the heterogeneity of the population on which it is computed. It is important to know through what range of talent the test was given from which the r is computed. To be comparable, two r's must have been computed from populations of some degree of heterogeneity or there must be some method of correcting one of the r's so as to indicate

what it would probably be if computed from the same type of population as that from which the one was derived with which it is being compared. The formulas used to make this correction were taken from page 257 in Dayhaw's⁹ book.

Formula 16.1¹⁰ was used for the intellectual group which was selected on the basis of intelligence. Then, for the musical group which was selected on a musical basis, formula 16.2¹¹ was used. Both of the formulas will be given and explained in the following chapter.

The corrected correlations obtained were tested for significance by the t test. To be significant the ratio should be greater than 2.660 at the one percent level or 2.000 at the five percent level.

The computation of the corrected correlations was followed by finding the difference between two correlations. In order to determine if this was a chance difference or a true difference it was necessary to find the Standard Error of difference between the two correlations. The Standard Error of the difference between the two r's was estimated by formula 109¹²:

⁹ Lawrence T. Dayhaw, Manuel de Statistique, Ottawa, Éditions de l'Université d'Ottawa, 1958, xxiii-530 p.

¹⁰ Lawrence T. Dayhaw, op. cit., p. 257.

¹¹ Lawrence T. Dayhaw, op. cit., p. 257.

¹² Charles C. Peters and Walter A. Van Voorhis, Statistical Procedures and their Mathematical Bases, New York, McGraw-Hill Book Co., 1940, p. 133.

$$\sigma_{r_{12} - r_{34}} = \sqrt{\sigma_{r_{12}}^2 + \sigma_{r_{34}}^2}$$

where $\sigma_{r_{12}}$ is the Standard Error of r_{12}
 $\sigma_{r_{34}}$ is the Standard Error of r_{34}

To determine whether this difference was significant the t test for significance was used. Formula 21.1¹³ was used:

$$t = \frac{D}{\sigma_D}$$

To be significant the ratio should be greater than 2.58 at the one percent level or 1.96 at the five percent level.

In this chapter the experimental design of the study has been outlined. The description of the tests and the sample population was followed by the method of the experiment. In the following chapters the results of the experiment are presented together with the conclusions based on these results.

¹³ Lawrence T. Dayhaw, op. cit., p. 355.

CHAPTER III

PRESENTATION AND DISCUSSION OF RESULTS

The experiment described in Chapter II produced three sets of results: first, the results from the correlations of the three groups of students, second, the correlations of the intellectual and musical groups corrected for restriction of range, and third, the results obtained when the intellectual and musical groups are compared.

A detailed study of the sixty correlations in Tables I, II, and III, below, yields some interesting information. Each factor of the Seashore Measures, namely, Pitch and Memory, and the two factors, Memory and Rhythm of the Drake Test are correlated with each of the factors of the Science Research Associates Primary Mental Abilities Tests, namely, Verbal Meaning, Space, Reasoning, Number, and word Fluency. Correlations marked with a single asterisk were found to be significant at the five percent level, and correlations marked with a double asterisk were significant at the one percent level. The correlations of each group have been presented in separate tables and the results for each group will be considered separately.

Table I, on page 41, contains the correlations for the Intellectual Group. Because this was a special group,

PRESENTATION AND DISCUSSION OF RESULTS

Table I.-

Uncorrected correlations between various tests for the Intellectual Group.

Test	Verbal Meaning	Space Reasoning	Number	Word Fluency
Seashore Pitch	-.0977	.3236	.0734	.0171
Seashore Memory	-.0686	.1536	.1131	-.1285
Drake Memory	.1018	-.0783	-.1541	.0424
Drake Rhythm	-.0591	-.1888	-.1756	-.0783

it was necessary to correct these correlations for restriction of intelligence range. The corrected correlations will be introduced and discussed later in this chapter.

Table II, page 43, contains the correlations for the Musical Group. It was necessary, here also, to correct these correlations for restriction of musical range. The corrected correlations for this group will be presented and discussed at a later time.

The results for the third group, the Unselected Group, have been given in Table III on page 44. From this table it can be seen that for the Seashore Battery correlations were found to be significantly greater than zero at the one percent level between: (a) Seashore Pitch and Verbal Meaning, (b) Seashore Pitch and Space, (c) Seashore Pitch and Reasoning, (d) Seashore Pitch and Word Fluency, (e) Seashore Memory and Space, and (f) Seashore Memory and Reasoning. Thus a correlation of .260 for (a), .337 for (b), .221 for (c), .234 for (d), .295 for (e), and .231 for (f) means that the chances are only one in one hundred that the observed correlations have arisen by chance alone. Six correlations for the Seashore battery, then, were found to be significant.

Table II.-

Uncorrected correlations between various tests for the
Musical Group.

Test	Verbal Meaning	Space Reasoning	Number	Word Fluency
Seashore Pitch	.0596	-.0199	.2097	.3117
Seashore Memory	-.1051	-.3423	.1055	.1521
Drake Memory	-.1008	.2528	-.2231	-.2915
Drake Rhythm	.0544	.1385	-.1379	-.0835

Table III.-
Correlations between various tests for the
Unselected Group.

Test	Verbal Meaning	Space Reasoning	Number	Word Fluency	
Seashore Pitch	.2595**	.3373**	.2206**	.0588	.2342**
Seashore Memory	.0737	.2953**	.2309**	.1409	.1049
Drake Memory	-.2467**	-.2694**	-.3226**	-.2069*	-.0960
Drake Rhythm	-.0502	.0020	-.1073	-.2767**	-.1176

* significant at the 5% level.

** significant at the 1% level.

For the Drake battery, correlations were found to be significantly greater than zero at the one percent level between: (a) Drake Memory and Verbal Meaning, (b) Drake Memory and Space, (c) Drake Memory and Reasoning, and (d) Drake Rhythm and Number. A correlation of $-.247$ for (a), $-.269$ for (b), $-.323$ for (c), and $-.277$ for (d) means that the chances are only one in one hundred that the observed correlations have arisen by chance alone. Also for the Drake battery, significance at the five percent level was found between Drake Memory and Number. The figure was $-.207$ and the chances are only five in one hundred that the correlation arose by chance alone. Five correlations for the Drake battery were found to be significant.

The negative correlations with the Drake Rhythm test might be due partly to the fact that in the Rhythm test the score is the sum of the differences between the examinee's answer and the correct answer. All differences are counted as positive. The positive number obtained in this manner is used as the raw score for the test. However, the explanation just given does not apply to the scoring technique of the Drake Memory test.

To sum up for the Unselected Group, it has been found that eleven out of twenty correlations were significant. For students in the unselected sample, therefore, it can be concluded that scores obtained on the music

aptitude battery show, in general, low significant relationship with scores made on the Science Research Associates Primary Mental Abilities Tests. The range of correlations is $-.323$ to $+.340$, with half of the correlations being positive. This might be considered evidence that music is somewhat related to intelligence.

The second set of results deals with the correlations which have been corrected for restriction of range for (1) the Intellectual Group and (2) the Musical Group. The corrected correlations were obtained through the application of two formulas. Formula 16.1¹ was used for the Intellectual Group and formula 16.2² was used for the Musical Group.

Restriction for the Intellectual Group was produced by selection on the basis of x_1 or intelligence and there is knowledge of the standard deviation in x_1 for both the restricted and unrestricted groups. The correlation between intelligence and music or r_{12} is known in the restricted group. The formula³ which was used is:

$$R_{12} = \frac{r_{12} \frac{\epsilon_1}{\sigma_1}}{\sqrt{1 - r_{12}^2 + r_{12}^2 \frac{\epsilon_1^2}{\sigma_1^2}}}$$

1 Lawrence T. Dayhaw, Manuel de Statistique, Ottawa, Éditions de l'Université d'Ottawa, 1958, p. 257.

2 Lawrence T. Dayhaw, op. cit., p. 257.

3 Lawrence T. Dayhaw, op. cit., p. 257.

In this formula,

r_{12} is the correlation between x_1 and x_2 in the restricted group,

σ_1 is the standard deviation in measurements on x_1 in the restricted group, and

ϵ_1 is the standard deviation in the same variable in the unrestricted group. This information is obtained from the profile for the Science Research Associates Primary Mental Abilities Tests. The profile is included in Appendix 3.

In the formula just cited, capital letters stand for values pertaining to the unrestricted population and lower case letters refer to the restricted population.

The corrected correlations for the Intellectual Group are shown in Table IV on page 48. The table shows both the original correlation and the correlation corrected for restriction of range. The original correlation appears on the top line for each music factor and the corrected correlation is found on the lower line.

In this table, correlations marked with a single asterisk are significant at the five percent level, and correlations marked with a double asterisk are significant at the one percent level.

For this Intellectual Group, correlations were found to be significantly greater than zero at the five

Table IV.-

Original and corrected correlations between various tests
for the Intellectual Group.

Test	Verbal Meaning	Space	Reason- ing	Number	Word Fluency
S ^a Pitch	-.098 ^c -.133 ^d	.324 .259*	.078 .113	.095 .077	.017 .016
S ^a Memory	-.069 -.098	.154 .121	.113 .162	-.067 -.056	-.129 -.124
D ^b Memory	.102 .138	-.079 -.062	-.154 -.222	-.074 -.060	.042 .041
D ^b Rhythm	-.059 -.081	-.189 -.149	-.176 -.249*	-.257 -.210	-.078 -.075

a The S. stands for Seashore.

b The D. stands for Drake.

c The original correlations for each factor are found on the top line.

d The corrected correlations for each factor are found on the second line.

* significant at the 5% level.

** significant at the 1% level.

percent level between: (a) Seashore Pitch and Space, and (b) Drake Rhythm and Reasoning. Thus a correlation of .259 for (a) and -.249 for (b) means that the chances are only five in one hundred that the correlations arose by chance alone. Only two correlations, then, were found to be significant for the Intellectual Group. The virtually complete absence of relationship is most striking. The conclusion here for the Intellectual Group is that there is a slight relationship between Seashore Pitch and Drake Rhythm in music and the Space and Reasoning factors in intelligence.

The corrected correlations for the Musical Group are considered next. Restriction for this group was produced by selection on the basis of x_1 or music and there is knowledge of the standard deviation for x_2 or intelligence in both the restricted and unrestricted samples and also of the r_{12} in the restricted group. Because ϵ_2 and σ_2 are known, instead of ϵ_1 and σ_1 , formula 16.2⁴ was used:

$$R_{12} = \sqrt{1 - \frac{\sigma_2^2}{\epsilon_2^2} \left(1 - r_{12}^2\right)}$$

⁴ Lawrence T. Dayhaw, op. cit., p. 257.

Here, in this formula,

σ_2 is the standard deviation on x_2 in the restricted group,

ϵ_2 is the standard deviation on the same variable in the unrestricted group. This information is obtained from the profile for the Science Research Associates Primary Mental Abilities Tests. The profile is found in Appendix 3.

r_{12} is the correlation between x_1 and x_2 in the restricted group.

In the formula just cited, capital letters stand for values pertaining to the unrestricted population and lower case letters refer to the restricted population.

The corrected correlations for the Musical Group are found in Table V on page 51. This table was set up similar to Table IV for comparison purposes and shows both the original correlation and the correlation corrected for restriction of range. The original correlation appears on the top line for each music factor and the corrected correlation is placed on the second or lower line.

In this table, correlations marked with a single asterisk are significant at the five percent level, and correlations marked with a double asterisk are significant at the one percent level.

A marked difference in the results for the Musical Group is evident. For the Seashore battery, correlations

Table V.-

Original and corrected correlations between various tests
for the Musical Group.

Test	Verbal Meaning	Space	Reason- ing	Number	Word Fluency
S ^a Pitch	.060 ^c .619 ^d **	-.020 -.873**	.210 .609**	.312 .239*	.192 -.272*
S ^a Memory	-.105 .622**	-.342 -.746**	.106 .591**	.152 -.142	.056 -.334**
D ^b Memory	-.101 .622**	.253 -.806**	-.223 .612**	-.292 .211	-.060 -.333**
D ^b Rhythm	.054 .618**	.139 -.854**	-.138 .595**	-.084 -.192	-.170 -.288*

a The S. stands for Seashore.

b The D. stands for Drake.

c The original correlations for each factor are found on the top line.

d The corrected correlations for each factor are found on the second line.

* significant at the 5% level.

** significant at the 1% level.

were found to be significantly greater than zero at the one percent level between: (a) Seashore Pitch and Space, (b) Seashore Pitch and Verbal Meaning, (c) Seashore Pitch and Reasoning, (d) Seashore Memory and Verbal Meaning, (e) Seashore Memory and Space, (f) Seashore Memory and Reasoning, and (g) Seashore Memory and Word Fluency. Thus a correlation of .619 for (a), $-.873$ for (b), .609 for (c), .622 for (d), $-.746$ for (e), .591 for (f), and $-.334$ for (g) means that the chances are only one in one hundred that the observed correlations have arisen by chance alone. Also for the Seashore battery, significance at the five percent level was found between: (a) Seashore Pitch and Number, and (b) Seashore Pitch and Word Fluency. The figures were .239 for (a), and $-.272$ for (b) and the chances are only five in one hundred that these correlations arose by chance alone. Every correlation involving Pitch of the Seashore battery was found to be significant. Four out of five correlations with Seashore Memory were found to be significant.

For the Drake battery, correlations were found to be significantly greater than zero at the one percent level between: (a) Drake Memory and Verbal Meaning, (b) Drake Memory and Space, (c) Drake Memory and Reasoning, (d) Drake Memory and Word Fluency, (e) Drake Rhythm and Verbal Meaning, (f) Drake Rhythm and Space, and (g) Drake Rhythm

and Reasoning. Thus a correlation of .622 for (a), -.806 for (b), .612 for (c), -.333 for (d), .618 for (e), -.854 for (f), and .595 for (g) means that the chances are only one in one hundred that the observed correlations have arisen by chance alone. Also for the Drake battery, significance at the five percent level was found between Drake Rhythm and Word Fluency. The figure was -.288 and the chances are only five in one hundred that the correlation arose by chance alone. There were eight correlations for the Drake tests, then, that were found to be significant.

The writer was somewhat surprised at the radical change in correlation that occurred as the correlations of the special music group were corrected for restriction of range. Take, as an example, the correlation between Seashore Memory and Verbal Meaning. Here, the correlation of -.105 changes to +.622. Then, too, in the case of the correlation between Drake Memory and Space, the correlation of .253 changes to -.806. Could such an extreme change be reasonably expected? In fact, these changes caused the writer to re-examine the procedures and formulas again and again. According to Guilford⁵, great changes in the correlation after correction for restriction of range are not

5 J. P. Guilford, Fundamental Statistics in Psychology and Education, Third Edition, McGraw-Hill, New York, 1956, p. 321.

unreasonable and are acceptable.

At this time also, a comparison of the M 's and σ 's on the music tests for the Musical Group was made with those of the Unselected Group. These results are shown on Table VI on page 55. A significant difference was found between the means but no significant difference was found between the standard deviations of the two groups.

In all, for the Musical Group, seventeen out of twenty correlations were significant. The range of correlations is $-.373$ to $.622$ with half of the correlations being positive. It should be noted that the three correlations which were not significant were those in which the Number factor was concerned. The evidence presented for the Musical Group seems to indicate that there is considerable relationship between the factors of the Seashore and Drake tests used in this experiment and the intelligence factors as measured by the Science Research Associates Primary Mental Abilities Tests. The results for the Musical Group, then, lend support to the view that general intelligence is a concomitant of musical talent.

Foregoing portions of this chapter have been concerned with the correlations of the three groups and with the correlations of the special groups corrected for restriction of range. The remainder of the chapter will be devoted to first, the subordinate problem of the thesis in

Table VI.-

Comparison of Means and Standard Deviations on the music tests of Musical and Unselected Groups.

Factors	Musical Group			Unselected Group			Mean σ		
	M	σ	σ_M	M	σ	σ_M	$\frac{D}{\sigma_D}$	Sig. $\frac{D}{\sigma_D}$	Sig.
Sea-shore Pitch	39.16	4.42	.54	32.03	6.54	.55	9.22 S	.27	N.S.
Sea-shore Memory	25.35	4.15	.51	18.61	5.54	.46	13.61 S	.19	N.S.
Drake Memory	42.5	12.65	1.55	63.46	12.70	1.08	-11.09 S	.002	N.S.
Drake Rhythm	55.51	18.59	2.27	65.03	43.27	3.67	-2.20 S	.52	N.S.

which an attempt is made to discover whether the intellectual students show a higher correlation between factors used in the study than the musical students show, and second, some discussion of the results found in the experiment, and finally, a brief summary of the chapter.

The last set of results to be presented is concerned with the subordinate problem of the thesis. The question is to discover whether the intellectual students show a higher correlation between factors than the musical students show. Differences in the correlations of the Intellectual and Musical Groups on all the factors were computed. The results are given in Table VII on page 57.

In order for t to be significant, that is, to indicate a difference in correlation not arising from chance factors, the value of t should be 1.96 or more. Careful scrutiny of the data showed that all the values for t turned out to be non significant.

From the results presented in Table VII, the general conclusion must be that for the two special groups used in this experiment, there is no significant difference in achievement on all the tests listed. The intellectual students did not show a higher correlation between factors than was shown by the musical students.

From the data submitted for the Intellectual Group it becomes evident that with only two exceptions the null

Table VII.-

Correlations of Intellectual Group compared to those
of the Musical Group

Factors	I ^a	M ^b	I - M	σ_D	t	Sig.
Seashore P. ^c vs V.M. ^d	-.133	.619	-.752	.63	-1.19	N.S.
Seashore P. vs S.	.259	-.873	1.132	.91	1.24	N.S.
Seashore P. vs R.	.113	.609	-.496	.61	-.81	N.S.
Seashore P. vs I.	.077	.239	-.162	.25	-.65	N.S.
Seashore P. vs W.F.	.016	-.272	.288	.27	1.07	N.S.
Seashore M. vs V.M.	-.098	.622	-.720	.63	-1.14	N.S.
Seashore M. vs S.	.121	-.746	.867	.76	1.14	N.S.
Seashore M. vs R.	.162	.591	-.429	.61	-.70	N.S.
Seashore M. vs N.	-.056	-.142	.086	.15	.57	N.S.
Seashore M. vs W.F.	-.124	-.334	.210	.36	.58	N.S.
Drake M. vs V.M.	.138	.622	-.484	.64	-.76	N.S.
Drake M. vs S.	-.062	-.806	+.744	.81	.92	N.S.
Drake M. vs R.	-.222	.612	-.834	.65	-1.28	N.S.
Drake M. vs N.	-.060	.211	-.271	.22	-1.23	N.S.
Drake M. vs W.F.	.041	-.333	.374	.34	1.10	N.S.
Drake R. vs V.M.	-.081	.618	-.699	.62	-1.13	N.S.
Drake R. vs S.	-.149	-.854	.705	.87	.81	N.S.
Drake R. vs R.	-.249	.595	-.844	.65	-1.30	N.S.
Drake R. vs I.	-.210	-.192	-.018	.28	-.06	N.S.
Drake R. vs W.F.	-.075	-.288	+.213	.30	.71	N.S.

a The I stands for the correlation of the Intellectual Group.

b The M stands for the correlation of the Musical Group.

c The musical factors are abbreviated as follows: P. means Pitch, M. means Memory, and R. means Rhythm.

d The intelligence factors are abbreviated as follows: V.M. means Verbal Meaning, S. means Space, R. means Reasoning, N. means Number, and W.F. means Word Fluency.

hypothesis is accepted. In the case of the two exceptions, however, the null hypothesis is rejected and the following conclusions are drawn:

1. There is a relationship between Seashore Pitch and Space of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level.

2. There is a relationship between Drake Rhythm and Reasoning of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level.

From the data submitted for the Musical Group it becomes evident that for seventeen cases the null hypothesis is rejected and the following conclusions are drawn:

1. There is a relationship between Seashore Pitch and Verbal Meaning, Space, and Reasoning of the Science Research Associates Primary Mental Abilities Tests significant at the one percent level.

2. There is a relationship between Seashore Pitch and Number and Word Fluency of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level.

3. There is a relationship between Seashore and Drake Memory and Verbal Meaning, Space, Reasoning, and Word Fluency of the Science Research Associates Primary Mental Abilities Tests significant at the one percent level.

4. There is a relationship between Drake Rhythm and Verbal Meaning, Space, and Reasoning of the Science Research Associates Primary Mental Abilities Tests significant at the one percent level.

5. There is a relationship between Drake Rhythm and Word Fluency of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level.

For the Musical Group the null hypothesis is accepted in three instances. No relationship was found between the factors, Memory in the Seashore battery and Memory and Rhythm in the Drake battery, and Number in the Science Research Associates Primary Mental Abilities Tests.

From the data submitted for the Unselected Group it becomes evident that for eleven cases the null hypothesis is rejected and the following conclusions are drawn:

1. There is a relationship between Seashore Pitch and Verbal Meaning, Space, Reasoning, and Word Fluency of the Science Research Associates Primary Mental Abilities Tests significant at the one percent level.

2. There is a relationship between Seashore Memory and Space and Reasoning of the Science Research Associates Primary Mental Abilities Tests significant at the one percent level.

3. There is a relationship between Drake Memory and Verbal Meaning, Space, and Reasoning of the Science Research

Associates Primary Mental Abilities Tests significant at the one percent level.

4. There is a relationship between Drake Memory and Number of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level.

5. There is a relationship between Drake Rhythms and Number of the Science Research Associates Primary Mental Abilities Tests significant at the one percent level.

On the other hand, for the Unselected Group the null hypothesis is accepted for the remaining relationships.

When each group was considered separately, both the Musical and Unselected Groups showed considerable relationship between factors. Then, when the two special groups were compared no significant difference was found.

As has been seen, the sixty correlations of this experiment have produced results which are most provocative. For the Unselected Group, eleven correlations out of twenty were found to be significant. Thus, slightly more than half of the correlations were proved to be of significance. For the Intellectual Group there were only two significant correlations. On the other hand, there were only three non-significant correlations for the Musical Group. It was interesting to find that the two special groups, Intellectual and Musical, presented such divergent results. This finding, however, supports the theory that persons who

possess high musical factors also possess high intelligence. However, this statement cannot be reversed. A person with high intelligence does not necessarily possess high musical traits.

To aid in the understanding of the results, it is important at this time to recall a few facts concerning the special groups. The Intellectual Group had IQ's ranging from 120 to 164, with the majority of scores lying above 130. The range of intellectual ability for this group is small. It is possible that the lack of relationship shown for this group is partially due to the restricted range of intellectual ability or perhaps to the inadequacy of the correction formula used.

When considering the Musical Group it is well to keep in mind the fact that the subjects of this group were not selected from the results of music tests but rather on the basis of teacher rating for qualities of musicality as shown by interest, achievement, and participation. For this group, scores on the intelligence tests are very significantly associated with scores on the music tests. The evidence points to the fact that persons who were termed musical were also intelligent.

It is suggested that the high relationship found for the Musical Group might be due to the halo effect in teacher's estimates. These music teachers may have

selected music students with a high intelligence or a group of students with a larger intellectual spread.

Because great care was exercised in obtaining the groups for the study and in administering the tests, the opinion is ventured that the cause for such differences in results may perhaps be due to the correction formulas that were used when the correlations were corrected for restriction of range. Possibly the true correlation of the Intellectual Group might be somewhere in between the Musical and Unselected Groups. It is further suggested that the findings for the two special groups may be so conflicting due to the amount of intellectual spread in the groups.

It should be noted, also, that in the selection of the musical students, the amount of musical training for each individual was not considered. Therefore, the amount varied. The writer was unable to surmount this difficulty in this piece of research with the large number of musical students. If only two or three students were used in a study, it might be possible to overcome this disturbing factor.

From the data at hand, the only conclusion that can be seen is that the musically superior students picked by teachers show a far greater relationship between factors than do the intellectually superior students.

This chapter, then, has presented the results of the experiment. The correlations for each group were presented and discussed. Before any discussion of the correlations was undertaken, it was necessary to correct the correlations for restriction of range. This was followed by a brief examination of the results obtained when the Intellectual and Musical Groups were compared. The chapter is concluded with a further consideration of results.

The final chapter consists of a summary of the entire investigation, the conclusions reached, and some recommendations for further study in the field of music.

SUMMARY AND CONCLUSIONS

The problem.- The purpose of this study was to determine the relationship, if any, existing between musical aptitude and intelligence. A subordinate problem was to discover whether the intellectual students showed a higher correlation between factors than the musical students showed. Musical aptitude factors were measured by the Seashore Measures of Musical Talents and by the Drake Musical Aptitude Tests; intelligence by the Science Research Associates Primary Mental Abilities Tests. The relationships of the results of the tests were investigated by correlation techniques.

Specification of the subjects and the samples.- The experimental subjects were Grade VII students attending Junior High Schools in the city of Winnipeg, Manitoba, Canada. The three groups of children who were used in the study were: (1) intellectual, (2) musical, and (3) unselected. The intellectual sample consisted of seventy-one students who were drawn from the major work classes in the city. The second sample consisting of sixty-eight musical students was chosen from music classes in the schools. Finally, the third sample which consisted of a group of one hundred and forty unselected students included all the students in the Grade VII classes in the Sisler High School.

Experimental material.- The nine tests selected for this study were: Memory and Pitch of the Seashore Measures of Musical Talents, Memory and Rhythm of the Drake Musical Aptitude Tests, and Verbal Meaning, Space, Reasoning, Number, and Word Fluency of the Science Research Associates Primary Mental Abilities Tests. These tests were administered in the latter part of the school term of the year 1958-1959.

Experimental plan.- The tests used in the study provided the data for the correlations and for the t tests. To investigate the possible relationships, sixty correlations were computed with the aid of a calculating machine. Then, forty of these obtained correlations were corrected for restriction of range. The formulas used in the correction were presented.

CONCLUSIONS

Correlations between music and intelligence for the Intellectual Group.- Only two findings of consequence were discovered in this study with regard to the relationship between music and intelligence for the Intellectual Group. Both of these corrected correlations were significant at the five percent level of significance. The Seashore Pitch factor showed some relation to the Space factor in the Science Research Associates Primary Mental Abilities Tests.

The Drake Rhythm factor also showed some relation to the Reasoning factor in the Science Research Associates Primary Mental Abilities Tests. The conclusion here is that the music factors, Seashore Pitch and Drake Rhythm, respectively, are more highly related than others to certain mental abilities, Space and Reasoning, in the factorial test as measured by the Science Research Associates Primary Mental Abilities Tests.

Correlations between music and intelligence for the Musical Group.- The findings for the Musical Group in this study with regard to the relationship between the factors of music and intelligence showed that seventeen of the corrected correlations were significant. Fourteen of these correlations were statistically significant at the one percent level of significance and three correlations were statistically significant at the five percent level of significance.

The Seashore Pitch factor showed considerable relationship to the factors of Verbal Meaning, Space, Reasoning, Number, and Word Fluency in the Science Research Associates Primary Mental Abilities Tests. The Seashore Memory factor also showed considerable relationship to the factors of Verbal Meaning, Space, Reasoning, and Word Fluency in the Science Research Associates Primary Mental Abilities Tests.

The Drake Memory and Drake Rhythm factors showed considerable relationship to the factors of Verbal Meaning, Space, Reasoning, and Word Fluency in the Science Research Associates Primary Mental Abilities Tests.

This study has presented evidence that for musical students a marked relationship is found between the musical factors, Seashore Pitch and Memory and Drake Memory and Rhythm and the intelligence factors, Verbal Meaning, Space, Reasoning, and word Fluency as measured by the Science Research Associates Primary Mental Abilities Tests.

Correlations between music and intelligence for the Unselected Group.- The findings in this study with regard to the relationship between the factors of music and intelligence for the Unselected Group disclosed eleven correlations which were statistically significant. Ten of these correlations were statistically significant at the one percent level of significance and one correlation was statistically significant at the five percent level of significance. The Seashore Pitch factor showed some relation to the factors of Verbal Meaning, Space, Reasoning, and Word Fluency in the Science Research Associates Primary Mental Abilities Tests. The Seashore Memory factor showed some relation to the factors of Space and Reasoning in the Science Research Associates Primary Mental Abilities Tests.

The Drake Memory factor showed some relation to the factors of Verbal Meaning, Space, Reasoning, and Number in the Science Research Associates Primary Mental Abilities Tests. The Drake Rhythm factor showed relationship with the Number factor of the Science Research Associates Primary Mental Abilities Tests.

For the unselected students, this study has presented evidence that music is somewhat related to intelligence.

With respect to the subordinate problem, it was found that when the correlations between factors of the Intellectual and Musical Groups were compared, no significant difference was shown. The Intellectual Group did not outrank the Musical Group.

Speculations and implications.- The correlations in the study, even those significant at the one percent level, are not significantly great to warrant depending on intelligence tests for indications of possible musical aptitude. It is possible that children who have had little or no musical training may have great musical capacities. Many a talented person is lost through sheer lack of recognition. Teachers should be concerned with the failure to discover, and, consequently, to train those who are musically gifted. All the knowledge that psychology and education can offer to discover these children in their

early childhood should be utilized. Continuous testing surveys should be part of every school system. If all school children were given music tests and auditions, they could then be directed to musical activities in proportion to their capacities. At the present time the music programs offered in the schools are not adequate and require further development in order to allow for such musical activities.

An adequate program of musical instruction is dependent upon knowledge of factors constituting musical talent. A good program could be developed for cultivation of these talents only after these talents and factors are known. The music tests not only locate talent but they clearly characterize various kinds of talent and recognition of differences in kinds of talent is important. There is a definite need in the field of music to understand the nature of a person's musical equipment. There is also a need to understand and explore the relationship of a person's musical equipment to other items in the total mental make-up. Further research which would uncover more about talent in its various manifestations is sorely needed. Both the music educator and the music psychologist would benefit from such information.

Summary of conclusions.-

- (1) The results for the first problem indicate that the intellectually gifted students of this study are not endowed with high musical talent.
- (2) The findings for the Musical Group show that there is a decided relationship between musical and mental factors for this group. The results seem to indicate that intelligence is a concomitant of musical talent.
- (3) The results for the Unselected Group seem to indicate that there is considerable relationship between the musical and mental factors.
- (4) With respect to the subordinate problem it was found that the intellectual students did not show a higher correlation between factors than was shown by the musical students.

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APPENDIX 1

A sampling of the raw data

Table VIII.--

Raw musical aptitude and intelligence scores
for the Intellectual Group.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
1	33	21	62	53	24	33	13	18	49
2	34	29	50	36	38	25	22	28	61
3	34	21	58	47	40	35	23	33	39
4	39	29	21	44	40	33	23	28	33
5	33	23	57	48	30	3	22	19	42
6	39	21	58	37	37	36	24	18	43
7	41	25	35	65	31	47	20	9	42
8	43	25	57	50	39	27	18	23	48
9	37	22	51	47	36	19	23	33	50
10	47	29	44	46	38	50	26	46	67
11	39	29	41	62	37	39	18	17	41
12	38	27	35	67	37	9	17	21	57
13	42	27	45	55	33	20	19	12	50
14	37	24	46	70	27	21	27	30	46
15	29	19	61	91	28	28	17	6	52
16	40	26	40	49	32	19	14	18	46
17	41	30	39	49	42	27	17	40	49
18	45	27	48	64	31	29	20	15	64
19	34	18	64	58	26	23	20	32	53
20	38	13	61	68	33	32	20	37	61
21	27	18	43	51	43	13	16	26	54
22	38	20	81	82	30	13	23	28	53
23	28	12	42	47	45	28	23	32	48
24	39	17	52	98	26	23	24	28	58
25	33	22	58	28	22	20	13	27	44
26	38	23	47	50	26	38	23	25	34
27	43	28	57	75	29	34	24	26	46
28	48	24	57	35	45	35	21	28	70
29	36	23	47	37	38	36	25	11	47
30	43	25	35	55	34	30	28	30	43
31	40	29	38	24	39	28	24	43	63
32	40	27	58	60	32	13	19	20	44
33	34	22	57	43	40	20	16	23	54
34	46	24	55	80	39	37	20	26	53

Table VIII - continued.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
35	43	25	60	50	30	43	23	26	61
36	42	19	56	86	34	25	15	18	57
37	47	29	39	38	28	30	19	30	33
38	45	29	33	33	38	37	29	33	57
39	45	29	45	64	31	6	17	21	38
40	40	28	59	82	29	25	23	19	34
41	38	23	61	140	32	23	27	24	52
42	42	26	52	35	26	17	22	33	67
43	30	17	56	59	39	13	26	26	55
44	40	28	25	44	30	33	28	28	47
45	37	15	54	58	38	18	22	32	56
46	40	22	67	90	28	32	17	16	55
47	40	26	41	49	32	39	20	20	48
48	42	28	25	54	22	28	20	28	37
49	40	27	40	64	36	28	25	21	58
50	44	25	42	73	36	18	19	20	56
51	37	27	31	61	19	7	15	15	33
52	42	29	38	27	32	45	23	28	34
53	40	28	49	53	37	42	19	26	48
54	44	30	32	34	36	22	17	25	52
55	39	27	47	52	39	54	26	23	31
56	44	29	45	89	37	36	13	30	44
57	43	25	45	36	28	51	22	27	32
58	42	22	54	48	39	45	22	19	47
59	40	21	58	59	33	23	24	16	48
60	40	27	56	82	28	24	18	8	36
61	39	20	81	110	39	18	15	10	21
62	24	17	74	81	39	17	24	31	46
63	44	24	46	57	29	22	21	48	37
64	38	20	51	46	44	42	24	27	40
65	39	29	49	78	43	23	25	12	39
66	40	24	50	45	28	34	22	27	46
67	35	7	78	116	37	31	12	31	47
68	33	26	52	68	42	38	17	33	44
69	34	27	39	52	37	17	22	10	67
70	40	25	50	54	37	40	22	21	36
71	40	26	91	78	48	40	22	28	44

Table IX.-

Raw musical aptitude and intelligence scores
for the Musical Group.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
1	38	28	42	33	27	0	20	18	43
2	36	21	50	24	24	2	18	17	28
3	35	28	32	36	13	15	7	13	35
4	36	24	45	34	26	19	18	35	37
5	41	25	55	66	37	47	16	36	52
6	45	27	32	36	14	15	27	26	54
7	39	26	49	35	29	19	21	19	29
8	38	30	24	47	23	17	25	30	30
9	41	25	53	81	18	25	13	20	14
10	35	30	33	44	23	6	10	19	43
11	41	28	44	65	18	41	18	22	56
12	22	9	49	57	25	21	11	19	33
13	40	25	41	50	19	20	13	21	36
14	30	19	41	38	30	26	22	25	54
15	40	29	40	30	19	22	17	25	40
16	42	26	47	69	22	23	15	19	42
17	39	21	56	69	22	35	27	24	39
18	42	30	16	60	25	10	17	27	51
19	42	26	43	52	21	7	16	27	31
20	42	29	53	84	24	28	19	14	50
21	39	27	48	40	20	30	20	28	36
22	42	26	19	102	24	8	22	12	40
23	45	29	22	41	33	26	19	32	49
24	42	24	38	103	22	28	9	23	35
25	43	26	42	41	35	25	22	34	41
26	45	27	37	60	37	5	18	26	41
27	46	24	40	37	22	34	20	31	55
28	42	30	55	62	5	30	20	25	54
29	41	22	43	59	30	35	22	21	64
30	43	26	28	56	31	8	18	30	40
31	28	22	55	65	24	25	20	17	48
32	42	27	27	52	24	16	19	23	52
33	48	28	31	60	42	8	16	21	53

Table IX - continued.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
34	44	28	15	61	26	22	21	28	46
35	39	20	58	72	31	25	28	15	58
36	37	23	60	59	17	0	11	14	41
37	45	29	22	52	16	14	15	27	41
38	41	22	61	58	27	17	16	13	44
39	43	25	38	62	24	17	17	19	45
40	39	26	31	35	32	23	21	28	36
41	42	25	39	28	11	22	17	22	45
42	43	29	26	68	21	6	16	23	40
43	34	27	62	52	21	17	10	10	40
44	39	26	38	68	21	19	9	13	39
45	40	30	29	38	12	17	16	12	44
46	37	28	38	41	24	23	11	14	31
47	37	22	60	112	18	26	14	30	44
48	36	10	61	64	26	52	20	18	39
49	36	24	26	44	19	12	18	18	53
50	38	29	34	47	22	20	21	23	36
51	41	28	30	47	27	46	22	31	55
52	34	26	40	45	30	38	21	33	45
53	42	28	41	50	17	6	17	15	39
54	41	27	39	43	22	13	12	33	61
55	32	20	69	72	19	13	10	9	34
56	40	22	58	104	22	25	9	20	67
57	40	27	50	83	24	0	23	39	64
58	39	17	61	71	23	25	13	19	61
59	42	29	33	48	19	9	21	16	57
60	41	24	53	33	17	8	11	13	52
61	41	27	48	50	29	26	18	17	32
62	40	28	40	40	26	10	15	17	49
63	41	21	55	47	28	26	14	22	37
64	33	28	47	45	26	1	18	22	46
65	31	19	70	58	20	32	12	12	34
66	36	30	47	54	27	13	20	18	43
67	35	27	37	80	38	14	19	18	64
68	34	29	44	56	17	4	14	10	44

Table X.-

Raw musical aptitude and intelligence scores
for the Unselected Group.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
1	34	16	59	46	29	10	8	14	44
2	40	19	68	45	26	13	16	11	31
3	34	16	63	31	27	23	18	37	48
4	28	20	52	385	24	24	19	23	29
5	37	25	40	61	16	16	14	13	41
6	21	9	60	46	16	0	10	3	33
7	35	11	59	58	21	11	22	22	49
8	27	13	66	93	15	0	5	13	25
9	32	16	80	50	13	31	11	10	30
10	21	10	77	57	13	18	16	26	32
11	28	12	71	264	20	16	18	6	29
12	27	19	52	48	15	15	21	24	43
13	32	19	59	52	22	13	15	26	35
14	16	26	31	17	17	28	14	31	25
15	35	29	50	40	15	26	24	10	23
16	26	19	62	59	17	25	8	23	30
17	35	18	49	34	25	26	13	21	32
18	28	25	41	37	17	16	20	23	38
19	38	12	60	73	23	20	15	8	29
20	31	22	66	54	18	27	13	32	22
21	17	13	58	45	19	12	11	15	25
22	32	17	82	73	10	21	12	16	33
23	35	21	45	42	22	11	12	36	38
24	27	14	76	65	14	14	15	18	42
25	23	7	54	31	23	4	10	20	34
26	15	15	80	65	22	8	12	27	43
27	31	19	54	30	19	18	11	28	23
28	37	16	72	42	15	19	13	26	40
29	38	20	71	47	30	14	14	15	40
30	30	11	65	36	28	12	14	38	37
31	29	24	60	42	13	0	7	21	28
32	34	29	26	36	23	18	15	19	42
33	34	21	72	45	18	0	17	15	34

Table X - continued.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
34	25	13	82	106	15	10	5	33	30
35	31	20	73	80	18	14	20	20	47
36	41	8	75	97	20	25	16	31	42
37	38	25	47	81	18	26	15	20	33
38	41	28	38	68	14	13	11	27	49
39	34	14	45	62	11	12	15	34	50
40	30	21	63	51	17	9	22	18	32
41	28	15	74	73	16	3	20	9	57
42	31	18	67	66	10	27	10	9	52
43	32	15	73	76	14	0	13	12	31
44	39	25	55	41	19	23	3	20	55
45	22	13	73	115	17	18	9	11	47
46	36	14	71	135	14	26	8	0	42
47	19	20	64	68	8	0	5	16	44
48	30	19	67	53	18	1	15	12	35
49	25	13	84	98	9	0	17	34	65
50	29	20	74	80	21	25	8	20	41
51	41	25	49	43	16	8	20	23	37
52	42	27	51	58	9	17	15	11	48
53	29	11	66	202	21	21	8	0	43
54	26	18	70	73	17	2	12	23	41
55	20	14	77	129	11	10	4	13	35
56	41	30	45	58	26	25	19	20	61
57	41	23	80	114	28	25	12	7	31
58	36	20	59	58	24	27	16	7	45
59	31	13	78	55	25	16	16	15	42
60	35	20	58	47	29	29	23	17	48
61	33	19	67	66	16	5	17	15	44
62	24	23	75	58	14	0	5	15	51
63	22	19	79	131	18	0	6	23	58
64	35	11	60	59	14	0	7	11	44
65	24	28	51	45	21	8	17	27	46
66	39	20	71	57	19	9	13	12	63
67	30	7	82	61	20	0	2	22	58
68	35	24	43	42	24	4	15	18	45
69	24	16	58	49	29	0	21	16	36

Table X - continued

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
70	27	15	74	82	19	35	10	14	46
71	26	27	67	77	17	10	8	30	41
72	26	11	82	72	16	5	9	18	57
73	39	25	53	33	11	31	22	16	53
74	24	9	75	134	13	7	16	25	39
75	27	24	53	32	25	8	18	12	65
76	30	15	72	94	20	14	17	9	58
77	34	14	66	33	22	9	13	24	40
78	41	26	43	34	12	31	22	24	61
79	30	12	63	28	23	16	16	20	54
80	40	30	47	42	18	27	9	24	50
81	42	26	69	49	23	18	11	23	65
82	45	21	70	34	20	12	15	35	56
83	23	13	75	55	13	15	11	30	39
84	24	10	82	77	21	0	8	22	42
85	42	25	69	195	18	31	15	5	40
86	39	24	45	40	15	34	21	24	42
87	30	12	58	45	20	38	19	22	59
88	40	19	41	27	35	10	13	33	52
89	33	18	67	57	16	28	25	23	41
90	27	18	57	46	23	28	15	34	46
91	41	26	35	26	15	27	22	27	49
92	32	18	56	57	22	2	15	26	54
93	37	21	51	65	20	34	22	25	56
94	34	25	50	135	19	19	11	17	31
95	28	15	74	51	20	35	18	40	43
96	31	22	58	37	20	8	18	12	53
97	45	29	35	35	17	34	20	27	40
98	46	28	55	27	27	26	14	39	47
99	32	22	49	44	26	13	22	46	54
100	39	16	73	40	23	3	10	38	58
101	43	22	51	60	29	49	18	29	59
102	42	26	48	91	28	41	18	20	48
103	32	22	54	52	30	35	18	43	37
104	39	23	54	22	23	30	16	27	48
105	34	20	62	56	19	0	17	26	48
106	25	17	59	112	30	5	12	25	61

Table X - continued.

Pupil	Seashore Pitch	Seashore Memory	Drake Memory	Drake Rhythm	Verbal Meaning	Space	Reasoning	Number	Word Fluency
107	35	22	71	53	23	38	11	15	35
108	37	17	65	101	19	12	17	14	45
109	29	16	74	69	24	16	21	24	52
110	25	18	85	54	15	23	17	18	45
111	30	20	71	38	18	23	20	26	50
112	35	22	57	36	25	20	20	22	49
113	41	21	69	60	28	16	16	31	48
114	38	14	67	47	20	24	10	28	40
115	37	19	55	61	15	27	23	35	60
116	33	16	69	56	19	0	19	23	58
117	32	17	67	38	20	35	15	41	49
118	42	23	46	54	31	12	9	35	50
119	24	19	78	40	12	18	16	27	30
120	39	27	64	72	18	0	6	9	24
121	26	14	75	56	13	0	2	15	23
122	39	23	61	68	14	13	10	19	42
123	36	25	46	41	16	17	15	10	23
124	29	13	81	61	17	20	5	8	37
125	24	12	71	60	18	6	12	18	38
126	32	12	69	67	9	8	10	22	26
127	24	23	70	82	10	5	14	32	38
128	36	11	86	58	16	0	18	8	33
129	26	10	78	53	12	0	17	13	31
130	25	19	75	44	11	0	20	17	40
131	36	9	70	88	21	2	9	9	25
132	33	16	83	91	11	28	9	11	44
133	24	15	83	45	24	23	10	12	25
134	32	20	69	60	13	12	13	31	35
135	38	16	63	47	18	22	14	18	42
136	34	21	75	49	8	0	10	22	29
137	27	20	60	84	18	39	24	17	30
138	30	19	72	36	21	36	14	26	34
139	27	18	74	68	10	0	9	24	34
140	34	21	69	67	17	12	11	25	28

APPENDIX 2

Music test forms

For each test, place your answers one below another in column A until that is filled, then down column B, and so on.

TIME

	A	B	C	D	E
1	L S	L S	L S	L S	L S
2	L S	L S	L S	L S	L S
3	L S	L S	L S	L S	L S
4	L S	L S	L S	L S	L S
5	L S	L S	L S	L S	L S
6	L S	L S	L S	L S	L S
7	L S	L S	L S	L S	L S
8	L S	L S	L S	L S	L S
9	L S	L S	L S	L S	L S
10					

TONAL MEMORY

	A	C
1	1 2 3	1 2 3 4 5
2	1 2 3	1 2 3 4 5
3	1 2 3	1 2 3 4 5
4	1 2 3	1 2 3 4 5
5	1 2 3	1 2 3 4 5
6	1 2 3	1 2 3 4 5
7	1 2 3	1 2 3 4 5
8	1 2 3	1 2 3 4 5
9	1 2 3	1 2 3 4 5
10		

SCORE
TIME
TIMBRE
TONAL MEMORY

Be sure your marks are heavy and black
Erase completely any answer you wish to change

TIMBRE

	A	B	C	D	E
1	S D	S D	S D	S D	S D
2	S D	S D	S D	S D	S D
3	S D	S D	S D	S D	S D
4	S D	S D	S D	S D	S D
5	S D	S D	S D	S D	S D
6	S D	S D	S D	S D	S D
7	S D	S D	S D	S D	S D
8	S D	S D	S D	S D	S D
9	S D	S D	S D	S D	S D
10					

	B
1	1 2 3 4
2	1 2 3 4
3	1 2 3 4
4	1 2 3 4
5	1 2 3 4
6	1 2 3 4
7	1 2 3 4
8	1 2 3 4
9	1 2 3 4
10	

QUICK SCORING ANSWER SHEET FOR THE MUSICAL MEMORY TEST

DIRECTIONS FOR FORM A AND FORM B:

1. You will hear a melody played on the piano. Listen carefully to the melody and try to remember it.
2. Then, listen carefully to the melodies that follow, and **COMPARE EACH OF THEM WITH THE FIRST MELODY**:

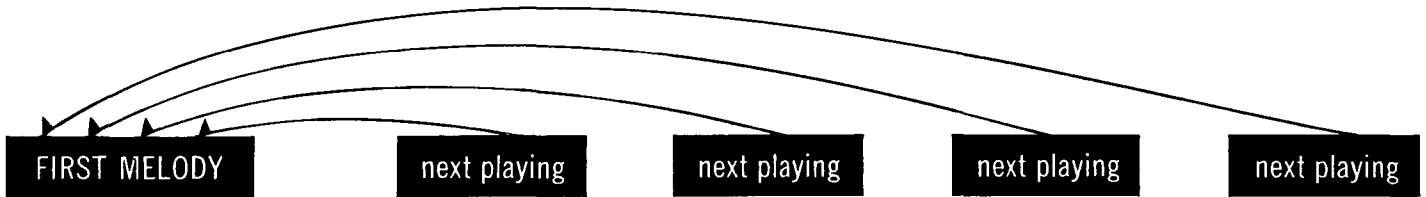
- If it is exactly the **SAME** as the first melody put **S** in the answer box
- If it is the same melody played in a different **KEY** put **K** in the answer box
- If the **TIME** has been changed put **T** in the answer box
- If any of the **NOTES** have been changed put **N** in the answer box

S
K
T
N

S=exactly the **SAME**
K=change of **KEY**

T=change of **TIME**
N=change of one or more **NOTES**

3. There is never more than one kind of change in any one comparison.
4. Write your answers—S, K, T, or N—during the short pause after each melody.
5. Here are four practice exercises. In each exercise, listen to the first melody, and then compare each of the next four melodies with the first melody as illustrated below:



PRACTICE EXERCISE NO. 1 . . .

--	--	--	--

PRACTICE EXERCISE NO. 2 . . .

--	--	--	--

PRACTICE EXERCISE NO. 3 . . .

--	--	--	--

PRACTICE EXERCISE NO. 4 . . .

--	--	--	--

6. If there is anything you do not understand, ask about it now.
7. In the test you will have 12 trials of entirely different melodies. Each trial will be announced by number. When you hear a number announced, you will know that a **NEW** melody is to be played.

MUSICAL MEMORY TEST

NAME _____ GRADE _____ AGE _____

CITY _____ SCHOOL _____ DATE _____

What musical instruments do you play? _____ Years studied _____

Have you had singing lessons? _____ Years studied _____

FORM A

Mark in each answer box one of the following letters:

- S = SAME
- K = KEY changed
- T = TIME changed
- N = NOTES changed

Make your answers clear and dark.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

FORM B

Mark in each answer box one of the following letters:

- S = SAME
- K = KEY changed
- T = TIME changed
- N = NOTES changed

Make your answers clear and dark.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

FORM A

Raw Score =

Musical Norms Percentile Rank =

Non Musical Norms Percentile Rank =

FORMS A + B

Raw Score =

Musical Norms Percentile Rank =

Non Musical Norms Percentile Rank =

FORM B

= Raw Score

= Musical Norms Percentile Rank

= Non Musical Norms Percentile Rank

QUICK-SCORING ANSWER SHEET FOR THE **RHYTHM TEST****DIRECTIONS FOR FORM A:**

1. You will hear a metronome beating at a certain rate.
2. A voice will count "one," "two," "three," "four," and you are to count silently along with it.
3. The voice and the metronome clicks will both stop at the count of "four," but you are to CONTINUE COUNTING—"five," "six," "seven," "eight," and so on—until the voice says "Stop!"
4. The number you have counted at the moment you hear "Stop!" is the answer you are to put down. (This includes the four counts—beats—you did along with the voice.) If you do not come out exactly on a beat, put down the nearest answer you think is correct. If you do not know the answer, put down your best guess.
5. You should feel the tempo (rhythm) and respond to it by pressing your finger against your desk to help you keep the beat exactly as started by the metronome. Do NOT tap your hands or feet or make any noise in any way.
6. You must concentrate very closely on a test like this. You will probably make a better score if you keep your eyes closed during the test. Do not make any noise or movement which will cause others taking the test to lose their count. Open your eyes only to write down your answers.
7. You will be given four practice exercises. Listen carefully, and put your answers in the answer boxes at the right.

1.	
2.	
3.	
4.	

PRACTICE EXERCISES FOR FORM A . . .

8. If you do not understand what you are expected to do, ask about it now.

DIRECTIONS FOR FORM B:

1. Form B is the same as Form A, except that where you had a silent interval of time, you will now have a distracting rate to which you must try to pay no attention. You must try to keep the rhythm of the first four beats.
2. You will have four practice exercises for Form B. Listen carefully, and write your answers in the answer boxes at the right. Keep your eyes closed except to write down your answers.

1.	
2.	
3.	
4.	

PRACTICE EXERCISES FOR FORM B . . .

3. If there is anything you do not understand, ask about it now.

RHYTHM TEST

NAME _____ GRADE _____ AGE _____

CITY _____ SCHOOL _____ DATE _____

What musical instruments do you play? _____ Years studied _____

Have you had singing lessons? _____ Years studied _____ Where? _____

FORM A

MARK YOUR ANSWERS IN
THE ANSWER BOXES BELOW.

Make your answers clear and dark!

1.	26.
2.	27.
3.	28.
4.	29.
5.	30.
6.	31.
7.	32.
8.	33.
9.	34.
10.	35.
11.	36.
12.	37.
13.	38.
14.	39.
15.	40.
16.	41.
17.	42.
18.	43.
19.	44.
20.	45.
21.	46.
22.	47.
23.	48.
24.	49.
25.	50.

FORM B

MARK YOUR ANSWERS IN
THE ANSWER BOXES BELOW.

Make your answers clear and dark!

1.	26.
2.	27.
3.	28.
4.	29.
5.	30.
6.	31.
7.	32.
8.	33.
9.	34.
10.	35.
11.	36.
12.	37.
13.	38.
14.	39.
15.	40.
16.	41.
17.	42.
18.	43.
19.	44.
20.	45.
21.	46.
22.	47.
23.	48.
24.	49.
25.	50.

TOTAL DIFFERENCE COLUMN 1	TOTAL DIFFERENCE COLUMN 2
FORM A	
Raw Score =	
Musical Norms Percentile Rank =	

FORMS A + B	
Raw Score	
Musical Norms Percentile Rank	
Non-Musical Norms Percentile Rank	

TOTAL DIFFERENCE COLUMN 3	TOTAL DIFFERENCE COLUMN 4
FORM B	
= Raw Score	
= Musical Norms Percentile Rank	
= Non-Musical Norms Percentile Rank	

APPENDIX 3

Intelligence test forms
and the Profile for the
Science Research Associates
Primary Mental Abilities Tests

ANSWER PAD
for the
SRA PRIMARY MENTAL ABILITIES
INTERMEDIATE—FORM AH
Prepared by L. L. Thurstone and Thelma Gwinn Thurstone

WORD-FLUENCY

Pratt

**STOP HERE—TURN BACK TO PAGE 10
AND FINISH READING THE INSTRUCTIONS**

DATE	1	36
	2	37
	3	38
	4	39
	5	40
	6	41
	7	42
	8	43
	9	44
	10	45
	11	46
	12	47
	13	48
	14	49
	15	50
	16	51
	17	52
	18	53
	19	54
	20	55
	21	56
	22	57
	23	58
	24	59
	25	60
	26	61
	27	62
	28	63
	29	64
	30	65
	31	66
	32	67
	33	68
	34	69
	35	70

STOP HERE—THIS IS THE END

When the examiner gives the signal, print your name and other information in the spaces provided on the left side of this page.

Directions for scoring are given on the inside of this Answer Pad. To remove the Answer Pad from the Test Booklet, hold the Answer Pad at the top left corner and lift upward.

NAME
Print

Initial

First

Last

9	7	5	3	1
	8	6	4	2
A R W		a b c f g h	A B C D E F	A B C D
B R W	A R W	d e f x y z	A B C D E F	A B C D
C R W	B R W	g h i j k l	A B C D E F	A B C D
D R W		x b c d e f	A B C D E F	A B C D
E R W		i j k l x y z	A B C D E F	A B C D
A R W	A R W	a b c f g h	A B C D E F	A B C D
B R W	B R W	x b c d e y	A B C D E F	A B C D
C R W	C R W	e d m n o p	A B C D E F	A B C D
D R W	D R W	a c d e f g	A B C D E F	A B C D
E R W	E R W	a b c d e f	A B C D E F	A B C D
A R W	A R W	h i j k l m	A B C D E F	A B C D
B R W	B R W	h i j k l m	A B C D E F	A B C D
C R W	C R W	e d i j k l	A B C D E F	A B C D
D R W	D R W	a b c d e f	A B C D E F	A B C D
E R W	E R W	a b c d e f	A B C D E F	A B C D
A R W	A R W	h i j k x y	A B C D E F	A B C D
B R W	B R W	d e f g h i	A B C D E F	A B C D
C R W	C R W	a b c d e f	A B C D E F	A B C D
D R W	D R W	i j k l m n o	A B C D E F	A B C D
E R W	E R W	g h i j k l	A B C D E F	A B C D
A R W		i j k n o p	A B C D E F	A B C D
B R W	A R W	g h i j k l	A B C D E F	A B C D
C R W	B R W	a b c g h i	A B C D E F	A B C D
D R W	C R W	a b c d e f	A B C D E F	A B C D
E R W		a b c x y z	A B C D E F	A B C D
A R W	A R W	g h i i m n	A B C D E F	A B C D
B R W	B R W	r s t w x y	A B C D E F	A B C D
C R W	C R W	a b c f g h	A B C D E F	A B C D
D R W	D R W	i j k l m n o	A B C D E F	A B C D
E R W	E R W	a b c x y z	A B C D E F	A B C D
A R W	A R W	e f g h i i	A B C D E F	A B C D
B R W	B R W	u v w x y z	A B C D E F	A B C D
C R W	C R W	i j k l m n	A B C D E F	A B C D
D R W	D R W	f g h x y z	A B C D E F	A B C D
E R W	E R W	h i j k l m	A B C D E F	A B C D
A R W	A R W	e f g h i i	A B C D E F	A B C D
B R W	B R W	p q r s t u	A B C D E F	A B C D
C R W	C R W	u v w x y z	A B C D E F	A B C D
D R W	D R W	h i j k l m	A B C D E F	A B C D
E R W	E R W	f g h i j k	A B C D E F	A B C D

APPENDIX 4

ABSTRACT OF

A Study of the Relationship between Musical Aptitude and Intelligence¹.

It was the purpose of this study to determine the relationship, if any, between musical aptitude and intelligence. The problem is stated in the form of two questions: (1) Is high musical talent found among the intellectually gifted? (2) Does intellectual talent accompany musical talent? A subordinate problem was to discover whether the intellectual students showed a higher correlation between factors than the musical students showed.

Musical aptitude was operationally defined in terms of scores made on Seashore Measures of Musical Talents for pitch and memory and on the Drake Musical Aptitude Tests for musical memory and rhythm. Intelligence was defined as that set of factors, namely, verbal meaning, space, reasoning, number, and word fluency, which were measured by the Science Research Associates Primary Mental Abilities Tests.

¹ Doctoral thesis presented by Josephine L. Zopf, in 1963, to the School of Psychology and Education of the University of Ottawa, vii-94 p.

The experimental subjects were Grade VII students attending Junior High Schools in the city of Winnipeg, Manitoba, Canada. The three groups of children who were used in the study were: (1) intellectual, (2) musical, and (3) unselected. The intellectual sample consisted of seventy-one students who were drawn from the major work classes in the city. The second sample consisting of sixty-eight musical students was chosen from the music classes in the schools. Finally, the third sample which consisted of a group of one hundred and forty unselected students included all the students in the Grade VII classes in the Sisler High School.

The testing program included the administration of four tests of musical aptitude and of five tests of intellectual factors. The tests were administered in the latter part of the school term of the year 1958-59.

The tests used in the study provided the data for the correlations and for the *t* tests. To investigate the possible relationships, sixty correlations were computed with the aid of a calculating machine. For the two special groups, intellectual and musical, the obtained correlations were corrected for restriction of range.

The findings for the first problem showed that there were two relationships of consequence: (1) There is a

relationship between the Seashore Pitch and Space factor of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level. (2) There is a relationship between the Drake Rhythm and the Reasoning factor of the Science Research Associates Primary Mental Abilities Tests significant at the five percent level. The intellectually gifted students of this study are not endowed with high musical talent.

The findings for the second problem showed that there was a decided relationship between the musical and mental factors. Seventeen relationships out of twenty were of significance. Fourteen of the correlations were significant at the one percent level of significance and three correlations were statistically significant at the five percent level of significance. Correlations ranged from $-.873$ to $+.622$. The results for the musical students of this study would seem to indicate that intelligence is a concomitant of musical talent.

The findings for the unselected group of students disclosed eleven significant correlations. Ten of these correlations were statistically significant at the one percent level of significance and one correlation was significant at the five percent level of significance. Correlations ranged from $-.323$ to $+.340$. The results for

the unselected group in this investigation seem to indicate that there is considerable relationship between the musical and mental factors.

With respect to the subordinate problem, it was found that when the correlations between factors of the two special groups were compared, no significant difference was shown. The intellectual students did not show a higher correlation between factors than was shown by the musical students.