AN EXPERIMENT WITH MUSIC COMPOSITION AS A SUPPLEMENT
FOR JUNIOR HIGH SCHOOL GENERAL MUSIC

by

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In the course of my work upon this study I have become indebted for aid to many individuals. Mr. H. Crooch Reynolds, Chairman of the Montana State University Music Department, proved an ingenious and imaginative person and was particularly helpful by developing the projects and providing helpful suggestions for the development of the Test of Musical Understanding.

For many stimulating suggestions and comments, I am indebted to the Montana State University Music Staff, particularly to Mary Sanks, and to Rolf Johnson.

For providing computer time and help with the statistics, I am deeply indebted to Albert Suvak.

For taking time to help in the preparation of this paper, I am very grateful to Professor Earl Fellbaum and Dr. Robert Thibeault.

As so often in the past, I am indebted to Adele W. Rate, my wife, for her untiring help and encouragement.

Richard T. Rate
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The purpose of this study was to determine if training in music composition increased students' competence in musical understanding. A group of 12 Bozeman, Montana, junior high school students were taught in a special music composition class in addition to their regular general music class. They were compared with a group of 54 Bozeman, Montana, junior high school students who did not experience the special music composition class. The differences between groups were adjusted statistically by an analysis of covariance involving the following factors: Test of Musical Understanding scores, California Test of Mental Abilities scores, number of years of participation in school music performance groups, number of years of private music lessons, and approximate number of minutes of music listening per day.

The students in both groups were given the present investigator's Test of Musical Understanding which was constructed with the help of the Montana State University Music Staff. The test was partially validated by using a group of 20 music majors and minors and a group of 155 music appreciation students.

The Test of Musical Understanding scores, along with the California Test of Mental Abilities scores, years of school music performance, years of private music lessons, and approximate number of minutes of daily music listening, were used to compute F ratios using an analysis of covariance. The computed F ratios were then compared with the critical F ratio found in statistical tables.

Conclusions arrived at as a result of this study were:
(1) Since none of the null hypotheses were accepted, perhaps differences in test scores between the two groups can be attributed to knowledge gained from the special instruction in music composition.
(2) If the above conclusion is correct, it would seem that music composition would be a worthwhile addition to the present general music curriculum.

Recommendations made were:
(1) A similar study should be conducted and a comparison of the results be made with the results of this study.
(2) Music composition should be incorporated and tested in the present junior high school curriculum.
(3) The Test of Musical Understanding should be revised and standardized.
CHAPTER I

NATURE OF THE PROBLEM

Music education, as well as other curricula, must of necessity undergo revision in order to meet changing needs of our societies. The possibilities for developing new methods in music education are unlimited. This study attempted to show one approach toward correcting some of the weaknesses of the present music curriculum and to foster future investigations in the field.

The problem investigated in this study was to determine if training in music composition increased students' competence in musical understanding. A group of 12 Bozeman, Montana, junior high school students were taught in a special music composition class in addition to their regular general music class. They were compared with a group of 54 Bozeman, Montana, junior high school students who did not experience the special music composition class. The differences between groups were adjusted statistically by an analysis of covariance involving the following factors: Test of Musical Understanding scores, California Test of Mental Abilities scores, number of years of participation in school music performance groups, number of years of private music lessons, and approximate number of minutes of music listening per day.
CHAPTER II
BACKGROUND OF THE PROBLEM INVESTIGATED

Present-day organization of public school music study seems, to the present investigator, to be quite limited and lacks the direction that might be supplied by a comprehensive and cohesive plan for learning. Instructional procedures rely almost entirely on strengths and weaknesses of directors of performance groups and teachers of general music classes in schools. Instruction in areas other than semi-intuitive musical understanding for performance, deals primarily with unrelated aspects of theory, history and musical literature.

This investigator feels that the student's grasp of definitions, processes of music, and his breadth and depth of aesthetic experience, in typical school instruction, are usually only incidental to the musical performance. In the general music class, an often captive and rebellious student is exposed to the singing of catchy tunes, listening to program music, the rudiments of music, and the more digestible aspects of music history.

Concepts of music as an art are traditionally reserved for students at the college level and are mainly reserved for those seeking a baccalaureate in music. Musical and academic instruction are not viewed as synonymous in the schools. Schools often consider music to be a "non-solid" subject.
Academicians and the public generally seem to feel that music is an art without an intellectual basis.

In this investigator's opinion, the following serious vacuums exist in current music instruction in public schools of this country:

1. There exists no clearly structured guidance toward musical understanding other than that necessary to the advancement of performance skills. It seems a safe conjecture that by far the greater number of those who carry from school a love for music gained it from performance or chance encounter in listening to, not from learning about, music.

2. Few students graduate from high school with the ability to understand and evaluate musical works. It is one thing for an instructor to say that Beethoven or Bartok was a great composer and quite another to provide the student with the insight to discern this greatness.

3. Commonly employed definitions of materials, processes, science and art of music are not universal in application. They fail in covering all historical periods and are not clear in their relation to each other. They mainly apply only to the period 1700-1900, and not entirely so even then. One such definition defines a scale as a series of seven tones, with a prescribed order of whole and half-steps written in a rising series above a key tone. (A study of school and collegiate texts produced this composite definition.)
Such a definition fails the student of electronic music, of serial composition, of music of the East, in fact, of all music based on scale organizations other than diatonic or modal. The common assumption that a key signature indicates the principal tonality of a composition can only cloud one's understanding of the music of Stravinsky or Machaut. Most students never learn that in the twentieth century commonly held definitions of key, key signature, scale, and tonality break down as a related sequence of definitions because the music may be polytonal, tonal without key or mode implications, or may alter scale components without alteration of tonality.

4. Only recently have attempts been made to relate the study of disciplines of music, materials and processes of composition (theory), music history, literature, acoustics and psychology of music, with the study of either performing or listening arts. These attempts are usually made at the secondary level after the student's musical interests have been formed, not while they are being formed.

It is possible that an essentially uninstructed aesthetic insight can become the birth of curiosity, of a desire to understand why. The science of astronomy began from the ancients' feelings of wonder at the beauty of the universe, mathematics from an aesthetic experience of discovery of relationships of numbers, geology from awe at some dis-
covery of the earth's history. To begin to comprehend relations between the materials and processes of musical composition is to begin to understand the why of an aesthetic experience in music. The student should, to understand the perspectives offered by music history and musical sciences, have knowledge of change in the emphasis and treatment of the processes of composition. Understanding of change could result in more cultivated, selective (yet broader taste), and aesthetic intellectual experiences of a far higher order. With instruction planned to guide learning through these channels, such understanding can be available, through our schools, to all pupils, regardless of their professional aim in life. Such understanding and communication is desirable for fruitful use of increased leisure. They will assist in adult adjustment to a progressively more computerized, mechanized and impersonal world.

This investigator feels that the addition of music composition might be used to improve the general music curriculum, although little study has been found in this area. No research information has been found relating to the use of composition as a teaching media and most mention of composition in music texts deals only with special cases. Jones (4:114-117) felt that composition is important to the intellectually gifted student and is a good outlet for the handicapped student. Hoffer (3:372) felt this way about composition for the average
students:

When the students show a reasonable mastery of fundamentals and aural comprehension, they can turn their attention to simple creative efforts, which will involve the study of harmony and arranging, and most important, the application of ear training and fundamentals.

The idea has been to teach fundamentals of theory, and, if these fundamentals are learned well enough, students might be encouraged to compose a simple tune.

Mills (5:43) conducted a special class in music composition for a group of "average" children, ages 11 through 14, who had only a classroom music background. The class covered, through study and composition, the basic elements of music: rhythm, melody, harmony, counterpoint and form. Mills felt that his class was a success. He did not evaluate this class in any way except through his personal feelings. Although the present investigator agrees with Mills, he can not accept unsubstantiated opinion as truth.

Likewise, Thomas (8:50-52) reported that several schools are using composition as a part of the regular general music classes. He stated that the classes were meeting a great amount of success. No research data was presented to help verify the truth of his feelings. Again the present investigator can not accept this unsubstantiated opinion as truth.

Fliegler (2:312) said that composing is a problem-solving process. Man's use of his intellect to solve prob-
lems of an abstract nature involves a high degree of mental
activity whether dealing with tonal or spacial configurations.
"The intellect is the basic operational essence in all cre-
avtivity."

The National Education Association Educational Policies
Commission (6:37-38), in its deliberation on the Education of
the Gifted, gave consideration to this phase of musical and
artistic giftedness with the comment:

The essence of the giftedness of musicians, ... appears to be creative imagination. In the cases of
artists and musicians an additional ingredient is
emotional sensitivity. General intelligence also
contributes—but just how and to what extent are
matters that are not yet well understood.

The present investigator feels that a series of creative
experiences in music composition will tend to teach more
permanent concepts and give the ability to more readily apply
these concepts.
The purpose of this study was to determine if training in music composition increased students' competence in musical understanding. A group of 12 Bozeman, Montana junior high school students were taught in a special music composition class in addition to their regular general music class. They were compared with a group of 54 Bozeman, Montana, junior high school students who did not experience the special music composition class.

Both groups were given the Test of Musical Understanding. Test scores were compared to determine what learning could be attributed to the music composition class. Possible differences between the two groups were adjusted statistically by an analysis of covariance involving the following factors: Test of Musical Understanding scores, California Test of Mental Abilities scores, number of years of participation in school music performance groups, number of years of private music lessons, and approximate number of minutes of music listening per day.

Experimental Sample

The students in the special composition class were volunteers who answered local advertising that a special music composition class for junior high school students would be
held on the campus of Montana State University. Of the 12
volunteers, five were boys and seven were girls. The special
class met for one hour on each of 18 Mondays in addition to
their regular general music classes. During this time, the
class completed nine projects of study under the guidance of
Mr. H. Creech Reynolds, chairman of the Montana State Univer¬
sity Music Department, Mrs. Mary Sanks, Mr. Rolf Johnson, and
the present investigator, members of the Montana State Univer¬
sity music staff. On the eighteenth meeting, the special
class was given the Test of Musical Understanding.

The other 54 students were members of two general music
classes in Bozeman Junior High School. This investigator
received permission, from the local school, to give the same
Test of Musical Understanding to the 54 students in the two
general music classes.

Construction of the Projects

The nine projects used in this study were constructed by
Mr. H. Creech Reynolds in consultation with Mrs. Mary Sanks
and the present investigator. Copies of the nine projects
are shown in Appendix A, page 31.

The projects were constructed using music composition as
a means of teaching the materials and processes of music.
Materials of music are here defined to mean the basic compon¬
ents of music: tonal, temporal, color and loudness materials.
Processes of music are here defined to mean the uses made of the materials of music.

The projects took the form of nine assignments in musical composition to be completed and performed by each member of the class. It was felt by those involved in the construction of the projects that the students could learn best by composing rather than hearing about music.

Several of the projects required that the students compose several measures of music within a given framework, while other projects left most of the decisions to the students themselves.

The melodic processes of repetition, sequence, inversion, and return, all with and without ornamentation, were considered an extremely important part of the projects.

Administration of the Projects

The nine projects were administered at the Montana State University Music Building, under the guidance of Mr. H. Creech Reynolds, Mrs. Mary Sanks, Mr. Rolf Johnson and the present investigator. As one project was completed and performed, the next project would be administered. All of the work was completed during the weekly hour class meeting. All materials were temporarily retained in order to further evaluate the individual projects and the quality of the work completed by the students.
In all cases, the projects were administered using a minimum of verbalization. Explanation of directions and definitions of terms were necessary in many cases. When questions arose, students answered each other's questions as much as possible.

It was hoped that through these nine projects, the students would gain a valuable insight into the composition of music. It was believed that students would not only have a more workable knowledge of written music, but would be able to recognize the results of the application of the processes of music upon hearing a musical composition and thus gain a greater appreciation for all music.

Construction of the Music Test

The Test of Musical Understanding was constructed by the investigator through consultation with the Montana State University Music Staff. A copy of the Test of Musical Understanding is shown in Appendix B, page 47.

The music test was constructed in three parts. The first part dealt with the recognition of the four materials of music: tonal materials, temporal materials, loudness materials, and color materials. In this part of the test, the student had to recognize a relationship between several musical terms without having the relationship defined. The directions stated to cross out each term that did not belong
with the rest. This part of the test consisted of six exercises with three responses in each exercise. An example of one of the exercises was:

**Exercise 2**

<table>
<thead>
<tr>
<th>C#</th>
<th>A♭</th>
</tr>
</thead>
<tbody>
<tr>
<td>key note</td>
<td>tonic</td>
</tr>
<tr>
<td>concert D</td>
<td>flute</td>
</tr>
<tr>
<td>440 vibrations per second</td>
<td>double reed</td>
</tr>
<tr>
<td></td>
<td>accent</td>
</tr>
<tr>
<td></td>
<td>middle C</td>
</tr>
<tr>
<td></td>
<td>F</td>
</tr>
</tbody>
</table>

The second part of the test consisted of listening to two melodic fragments and determining if they were the same or different. Each exercise was designed to test the student's ability in melodic perception. This part of the test consisted of 12 exercises.

The third part of the test consisted of 18 exercises designed to measure the student's ability in recognizing and applying melodic processes. Each exercise was in four parts. It was necessary for the student to determine whether the relationship between parts one and two was the same as or different from the relationship between parts three and four.

The entire test, including all directions and musical examples, was recorded on magnetic tape. The test required 35 minutes to administer. All directions and musical examples were recorded by Mrs. Adele W. Rate and the present investigator.

Along with the test was a cover sheet (see Appendix B,
which was used to gain information on years of music performance, years of private music lessons, and minutes of daily music listening.

In addition to consultation with members of the Montana State University Music Staff for verification of test items, the test was given to 20 music majors and minors (Group 1) and 155 music appreciation students (Group 2) in order to determine if students with greater musical training could score significantly higher than students without this musical training. The results of this test are discussed later in this chapter.

Through consultation with Montana State University Music Staff, it was decided that the following factors, as well as musical training, might affect the score that a student received on the test: intelligence, years of music performance, years of private music lessons, and number of minutes of music listening per day. This meant that if the test scores were adjusted for the above factors, there might be no significant differences between the test scores of the two groups. This was stated as "null hypotheses" for statistical purposes. The null hypotheses stated that there would be no significant difference between the test scores of the two groups after they were adjusted for the factors mentioned.

Through statistical methods the F ratio was computed. This computed F ratio was then compared with the critical F ratio found in a statistical table. If the computed F ratio
was larger than the critical table F ratio, the null hypothesis was not accepted.

Each of the null hypotheses investigated was not accepted. By not accepting the null hypotheses, the investigator was able to assume that the differences between groups in the Test of Musical Understanding scores could be attributed to musical training. Since the differences were attributed to musical training, the investigator felt that his test could be used to test for musical training with other groups.

Following are the results of the analysis of covariance. More detailed statistics may be found in Appendix C, page 58 and Appendix D, page 67.

According to Ostle (7:457) the critical value of the F ratio at the .95 level of confidence for one and 173 degrees of freedom, critical F ratio (.95;1,173), is 3.91.
The null hypothesis assumed was: No difference exists between the test scores of Group 1 (music majors and minors) and Group 2 (music appreciation students) when adjusted for differences in intelligence using Ohio Test scores.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>20</td>
<td>155</td>
</tr>
<tr>
<td><strong>Mean of Ohio Test scores</strong></td>
<td>47.35</td>
<td>44.24</td>
</tr>
<tr>
<td><strong>Mean of Music Test scores</strong></td>
<td>43.70</td>
<td>36.95</td>
</tr>
<tr>
<td><strong>Adjusted Mean of Music test</strong></td>
<td>43.39</td>
<td>36.99</td>
</tr>
<tr>
<td><strong>Computed F ratio</strong></td>
<td></td>
<td>41.79</td>
</tr>
<tr>
<td><strong>Critical F ratio (.95;1,173)</strong></td>
<td></td>
<td>3.91</td>
</tr>
</tbody>
</table>

The computed F ratio was 41.79. The critical F ratio (.95;1,173) is 3.91. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in intelligence. The differences could be due to musical training or to some other factor.
The null hypothesis assumed was: No difference exists between the test scores of Group 1 (music majors and minors) and Group 2 (music appreciation students) when adjusted for differences in years of musical performance.

Table 2
Adjusted Means and F ratios for Groups 1 and 2 for Years of Musical Performance

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>155</td>
</tr>
<tr>
<td>Mean of Performance Years</td>
<td>8.15</td>
<td>3.34</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>43.70</td>
<td>36.95</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>41.98</td>
<td>37.17</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>21.08</td>
</tr>
<tr>
<td>Critical F ratio (.95;1,173)</td>
<td></td>
<td>3.91</td>
</tr>
</tbody>
</table>

The computed F ratio was 21.08. The critical F ratio (.95;1,173) is 3.91. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in years of musical performance. The differences could be due to musical training or to some other factor.
The null hypothesis assumed was: No difference exists between the test scores of Group 1 (music majors and minors) and Group 2 (music appreciation students) when adjusted for differences in years of private music lessons.

Table 3
Adjusted Means and F ratios for Groups 1 and 2 for Years of Private Music Lessons

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>155</td>
</tr>
<tr>
<td>Mean of Lesson Years</td>
<td>7.10</td>
<td>2.28</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>43.70</td>
<td>36.95</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>42.52</td>
<td>37.10</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>24.77</td>
</tr>
<tr>
<td>Critical F ratio (.95;1,173)</td>
<td></td>
<td>3.91</td>
</tr>
</tbody>
</table>

The computed F ratio was 24.77. The critical F ratio (.95;1,173) is 3.91. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in years of private music lessons. The differences could be due to musical training or to some other factor.
The null hypothesis assumed was: No difference exists between the test scores of Group 1 (music majors and minors) and Group 2 (music appreciation students) when adjusted for differences in minutes of daily music listening.

Table 4
Adjusted Means and F ratios for Groups 1 and 2 for Minutes of Daily Music Listening

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>155</td>
</tr>
<tr>
<td>Mean of Minutes of Listening</td>
<td>62.50</td>
<td>131.13</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>43.70</td>
<td>36.95</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>44.00</td>
<td>36.91</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>43.17</td>
</tr>
<tr>
<td>Critical F ratio (.95; 1, 173)</td>
<td></td>
<td>3.91</td>
</tr>
</tbody>
</table>

The computed F ratio was 43.17. The critical F ratio (.95; 1, 173) is 3.91. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in minutes of daily music listening. The differences could be due to musical training or to some other factor.
Administration of the Music Test

The Test of Musical Understanding was administered to the 12 student volunteers on the eighteenth meeting of the special music composition class. Three weeks later, the test was administered to the 54 members of two Bozeman Junior High School general music classes. Both tests were given using the same Ampex 620 tape machine. All of the tests were hand graded by the investigator.

Analysis of Data

The central problem of this study was to determine if training in music composition increased students' competence in musical understanding. A group of 12 junior high school students were presented musical concepts through their work in music composition in addition to their regular general music class work. They were compared with 54 general music class students who received only the regular general music class instruction.

Both groups were given the Test of Musical Understanding. Differences between the groups were adjusted statistically by an analysis of covariance involving the following factors: Test of Musical Understanding scores, California Test of Mental Abilities scores, number of years of participation in school music performance groups, number of years of private music
lessons, and approximate number of minutes of music listening per day.

All tests were hand graded by the present investigator. Test scores and other scores mentioned above were punched on computer cards. The computer was used for calculation of the analysis of covariance and adjusted means. Computed F ratios were compared with the critical F ratio taken from a statistical table to determine if there was any significant difference.

One object of the experimental design was to insure that the results observed could be attributed within limits of error, to the treatment variable and to no other causal circumstance. According to Ferguson (1:326) the analysis of covariance is a statistical, rather than an experimental method, which may be used to "control" or "adjust for" the effects of one or more uncontrolled variables, and permit, thereby, a valid evaluation of the outcome of the experiment.
CHAPTER IV

RESULTS

Test of Musical Understanding scores were obtained for 12 junior high school students in the special music composition class. Test of Musical Understanding scores were also obtained for 54 general music students from two classes of general music at Bozeman Junior High School.

California Test of Mental Abilities scores, years of music performance in school music groups, years of private music lessons, and approximate number of minutes of music listening were also obtained for the 66 students mentioned above.

Analysis of Covariance and Calculation of Adjusted Means were computed from the above scores. Following are the results of the computations. More detailed statistics may be found in Appendix C, page 58 and Appendix D, page 67.

It was felt that if the test scores were adjusted for the factors of intelligence, years of music performance, years of private music lessons, and minutes of daily music listening, there might be no significant difference between the test scores for the two groups. This was stated as null hypotheses for statistical purposes. The null hypotheses stated that there would be no significant difference between the test scores of the two groups after they were adjusted for the factors mentioned.
Through statistical methods the F ratio was computed. This computed F ratio was then compared with the critical F ratio found in a statistical table. If the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted.

Each of the null hypotheses investigated was not accepted. By not accepting the null hypotheses, the investigator was able to assume that the differences between groups in the Test of Musical Understanding scores could be attributed to musical training received in the special music composition class.

According to Ostle (7:457) the critical value of the F ratio at the .95 level of confidence for one and 63 degrees of freedom, critical F ratio (.95;1,63), is 3.99.
The null hypothesis assumed was: No difference exists between the test scores of Group 3 (special class students) and Group 4 (general music class students) when adjusted for differences in intelligence using California Test of Mental Abilities scores.

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td>Mean of California Test Scores</td>
<td>122.58</td>
<td>124.20</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>41.33</td>
<td>37.22</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>41.46</td>
<td>37.19</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>14.41</td>
</tr>
<tr>
<td>Critical F ratio (.95;1,63)</td>
<td></td>
<td>3.99</td>
</tr>
</tbody>
</table>

The computed F ratio was 14.41. The critical F ratio (.95;1,63) is 3.99. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in intelligence.
The null hypothesis assumed was: No difference exists between the test scores of Group 3 (special class students) and Group 4 (general music class students) when adjusted for differences in years of musical performance.

Table 6
Adjusted Means and F ratios for Groups 3 and 4 for Years of Musical Performance

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td>Mean of Years of Musical Perf.</td>
<td>4.08</td>
<td>1.46</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>41.33</td>
<td>37.41</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>40.49</td>
<td>37.41</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>5.43</td>
</tr>
<tr>
<td>Critical F ratio (.95;1,63)</td>
<td></td>
<td>3.99</td>
</tr>
</tbody>
</table>

The computed F ratio was 5.43. The critical F ratio (.95;1,63) is 3.99. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in years of musical performance.
The null hypothesis assumed was: No difference exists between the test scores of Group 3 (special class students) and Group 4 (general music class students) when adjusted for differences in years of private music lessons.

Table 7
Adjusted Means and F ratios for Groups 3 and 4 for Years of Private Music Lessons

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td>Mean of Music Lesson Years</td>
<td>3.25</td>
<td>1.81</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>41.33</td>
<td>37.10</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>40.95</td>
<td>37.31</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>9.42</td>
</tr>
<tr>
<td>Critical F ratio (.95;1,63)</td>
<td></td>
<td>3.99</td>
</tr>
</tbody>
</table>

The computed F ratio was 9.42. The critical F ratio (.95;1,63) is 3.99. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in years of private music lessons.
The null hypothesis assumed was: No difference exists between the test scores of Group 3 (special class students) and Group 4 (general music class students) when adjusted for differences in minutes of daily music listening.

Table 8
Adjusted Means and F ratios for Groups 3 and 4
for Minutes of Daily Music Listening

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td>Mean of Minutes of Listening</td>
<td>88.75</td>
<td>112.31</td>
</tr>
<tr>
<td>Mean of Music Test scores</td>
<td>41.33</td>
<td>37.22</td>
</tr>
<tr>
<td>Adjusted Mean of Music test</td>
<td>41.33</td>
<td>37.22</td>
</tr>
<tr>
<td>Computed F ratio</td>
<td></td>
<td>12.25</td>
</tr>
<tr>
<td>Critical F ratio (.95;1,63)</td>
<td></td>
<td>3.99</td>
</tr>
</tbody>
</table>

The computed F ratio was 12.25. The critical F ratio (.95;1,63) is 3.99. Because the computed F ratio was larger than the critical F ratio, the null hypothesis was not accepted. This means that the difference between the test scores of the two groups probably was not due to the differences in years of musical performance.
The purpose of this study was to determine if training in music composition increased students' competence in musical understanding. A group of 12 Bozeman, Montana, junior high school students were taught in a special music composition class in addition to their regular general music class. They were compared with a group of 54 Bozeman, Montana, junior high school students who did not experience the special music composition class. The differences between groups were adjusted statistically by an analysis of covariance involving the following factors: Test of Musical Understanding scores, California Test of Mental Abilities scores, number of years of participation in school music performance groups, number of years of private music lessons, and approximate number of minutes of music listening per day.

The students in both groups were given the present investigator's Test of Musical Understanding which was constructed with the help of the Montana State University Music Staff. The test was partially validated by using a group of 20 music majors and minors and a group of 155 music appreciation students.

The Test of Musical Understanding scores, along with the California Test of Mental Abilities scores, years of school music performance, years of private music lessons, and approx-
imate number of minutes of daily music listening, were used to compute $F$ ratios using an analysis of covariance. The computed $F$ ratios were then compared with the critical $F$ ratio found in statistical tables.

**Conclusions**

The following conclusions seemed warranted from the results of this study:

1. Since the comparisons of the computed $F$ ratios and the critical $F$ ratio showed that the special music composition class scored significantly higher than the general music classes on the *Test of Musical Understanding* and none of the null hypotheses were accepted, perhaps differences in test scores between the two groups can be attributed to knowledge gained from the special instruction in music composition.

2. If the above conclusion is correct, it would seem that music composition would be a worthwhile addition to the present general music curriculum.

**Recommendations**

The following recommendations seem to follow from this study:

It is recommended that a similar study be conducted and a comparison of the results be made with the results of this study. Perhaps a similar study might use students of ages
other than junior high school age. A similar study might well be restricted to only one grade level.

It is recommended that music composition be incorporated and tested in the present junior high school curriculum. In the regular class situation, control groups could be used for better verification of the findings. Perhaps a study over a period of several years should be made comparing musical interests of students who received training in music composition with students who did not receive such training.

It is recommended that the Test of Musical Understanding be revised and standardized.
APPENDICES
APPENDIX A.

Experiment in Musical Understanding Projects
Assignment

1. In this project treat the tone "C" as tonic, as the tone to go away from and return to. Select one other tone as your next most important tone, as the one you mainly go away toward — and come back from. This tone, which may be changed by a sharp or flat, will be _____. (D, E, and G are the only other tones in all three Tonal Materials)

I. Tonal

II. Temporal

III. Loudness

A. Up to four accent marks may be used during each temporal group to show groupings or emphasis.

B. You have free choice in using or not using dynamic markings.

2. Select your choice from Tonal Materials A, B, or C above. Use only those tones to write a melody with Temporal Materials #1. You may repeat tones. Stay within a two-octave range.
3. Select a different set of Tonal Materials from A, B, or C. Keep "C" as tonic. Write a continuation of your melody on these tones, using Temporal Materials #2.

4. Return to your first Tonal Materials selection to write an ending to your melody, using Temporal Materials #3.

5. You may wish to use up to four accent marks (>) in each of the sections of your melody to show groupings of tones or for emphasis of important moments. You may use dynamic marks.
Assignment

Write two different melodies, using the given tonal and temporal materials. Write the upper melody in treble clef and the lower melody in a different clef. Choose any two instruments from the instrument list as your Color Materials.

Tonal Materials (Use only these pitches; do not change octave.)

violin bassoon viola French horn clarinet
oboe trombone piano trumpet
flute piano

Tonic: F
For interval measurement, write the letter names of the tones you used for each note of the temporal materials, one over the other on the graph below.

<table>
<thead>
<tr>
<th>C</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The lines below are a sort of measuring-stick of intervals, that is, of the distance between different pitches. Use this measure to record the intervals you find between the pairs of tones from your two melodies.

---

--- --- (octave)
--- S ---
--- m ---
--- M ---
--- P ---
--- P --- (Perfect, fourth)
--- M --- (Major, third)
--- m --- (minor, third)
--- S --- (Second, major)
--- (unison)

Place the lowest line of this measure opposite the line for the lower of each pair of tones. Then record the S, m, M, or P at the foot of the assignment page below each pair of tones.

When you have finished the interval measurement, use the graph below to show the contour of your two melodies. Place a small x on the proper letter-name line for every tone, then connect the x's with a line.
Expariment in Musical Understanding
Department of Music
Montana State University

PROJECT #3
NAME: ______________________

Tonal Materials. Tonic is F.

\[
\begin{array}{c}
\text{violin} \\
\text{oboe} \\
\text{flute} \\
\text{piano} \\
\text{clarinet} \\
\text{viola} \\
\text{bassoon} \\
\text{trumpet} \\
\text{trombone} \\
\text{piano}
\end{array}
\]

Upper Melody Inst. Lower Melody Inst.

Temporal Materials

\[
\begin{array}{c}
\frac{4}{4} \quad \frac{1}{2} \quad \frac{1}{2} \quad 1 \quad 1 \quad 2 \quad 1
\end{array}
\]

Assignment

This is an assignment in the uses of parallel \(\parallel\parallel\), contrary \(<>\), and oblique \(\ll\ll\), motion of two melodies. These words are not exact descriptions of melody-relation, but show general relation.

Step 1. Write a melody in treble clef using the given tonal and temporal materials for any of the instruments. Remember that Tonic is F.
Step 2. Choose either parallel, contrary, or oblique motion, see a, b, or c, below. Write your second melody on one lower staff. As tonic is F, end this melody on F even if it means breaking your rules of motion.

a. Parallel: Begin your second melody on a different tone than the upper melody begins on. Move each tone in the same direction as the upper melody tones move from one to the next. End on F.

b. Contrary: Begin your second melody on any tone. Move each tone in the opposite direction to the motion of its upper neighbor. End on F.

c. Oblique: Begin your second melody on any tone. If the upper melody moves up or down, keep lower tone the same. If the upper melody stays on the same pitch, move the lower melody up or down. (Be sure to repeat a tone or two in the upper melody if you choose oblique motion.) End on F.
Experiment in Musical Understanding
Department of Music
Montana State University

PROJECT #4

NAME: ____________________________

Tonal Materials. Tonic is F

Temporal Materials: Use either of Project #3 melodies.

Color Materials: Use any instrument in the class.

Processes:
1. Repetition. Repeat musical material immediately.
2. Return. Repeat of musical material, but only after other material has been used in between statements.
3. Sequence. Repetition of musical material at a different pitch level.
5. Ornamentation. Repetition of musical material, but with new tonal and temporal materials sandwiched between tones of original materials.
6. Change of one material. To alter tonal or temporal material while the other remains same.

Assignment:
1. Copy upper or lower melody from Project #3. Show clef.

2. Use Process of:
   a. Sequence, or
   b. Repetition, or
   c. Inversion, or
   d. a, b, c, with ornamentation.
3. Use Process of:
   a. Repetition of 2a or 2c.
   b. Sequence of 2b or 2c.
   c. Inversion of 2a or 2b.
   d. a, b, or c, with ornamentation.

4. Use Process of:
   a. Return of 1.
   b. Return of 1, with change of one material.
   c. Return of 1, with ornamentation.

5. Copy complete composition on fresh staff paper.
Experiment in Musical Understanding
Montana State University
Department of Music

PROJECT #5

NAME: _______________________

Tonal Materials: Tonic is G

\[ \text{or} \]

Temporal & Loudness Materials:

1. \( \frac{3}{4} \) \( \begin{array}{c} 1 \ 2 \end{array} \)
2. \( \frac{3}{4} \) \( \begin{array}{c} 1 \ \ 2 \end{array} \)
3. \( \frac{3}{4} \) \( \begin{array}{c} 1 \ \ 2 \end{array} \)
4. \( \frac{3}{4} \) \( \begin{array}{c} 1 \ \ 2 \end{array} \)

Process: Creation of a Motive

By combining tonal, temporal, and loudness materials you can create motives. Motives are building materials for creating larger sections of music. Tests of a good motive: How well does it work for you in expressing what you want it to; how well does it respond to the processes you apply to it?

Assignment:

1. Write four motives, one for each of the Temporal patterns above. These will become some of your materials for later assignments.

2. In the remaining time, experiment with your motives by applying to them some of the Processes from PROJECT #4. Also try them with slower and faster beat (tempo), or try one after another.
Project #6

NAME: ____________________________

Tonal Materials: Tonic is G.

Use only these tones, but you may use them in any octave.

Process: Motive Development.

Assignment:

1. Select two of the four motives you created in Project #5. Use any processes from the list below that you find suitable for writing two four-measure sections of melody. You may find it helpful to begin the second four-measure section by applying some process to the first section.

2. Use the other two motives from Project #5 to write two more four-measure sections in the same way.

Processes:

1. Repetition
2. Return
3. Sequence
4. Inversion
5. Ornamentation
6. Change of temporal Material
Assignment: Select, after hearing, one of the three progressions below as the one for which you will write a melody -- using the proper given Tonal Materials.

1. To write your melody, decide on one or two contour lines for the eight measures.

2. AT ANY TIME DURING THE MELODY you may use any tones of the chord beneath the melody tone(s),

OR:

3. You may use any other tone of the Tonal Materials for that measure SO LONG AS IT MOVES STEPWISE into a chord tone.
Assignment: Organize materials for a performance of CHANCE MUSIC (Aleatory Music)

Materials: Ostinatos
1. Write an ostinato for a percussion instrument. It should have no more than five notes and should be planned for regular repetition.
2. Write a tonal ostinato of not more than three different tones, in a rhythmic pattern of not more than five notes.

Tonal Materials for Ostinato #2

Fragments
1. Write three fragments of music of a few to several tones; show speed of performance, dynamic levels, and instruments to perform each.

Tonal Materials for Fragment #1

Tonal Materials for Fragment #2

Tonal Materials for Fragment #3

NAME: ________________________________
1. Indicate below three percussion sounds.

Sound #1  Sound #2  Sound #3

Instr:  

Instructions: Copy all of the above materials on your score, and write out players' parts on staff paper for Ostinatos and Fragments.
Information Sheet

For this project you are to write a complete orchestration of the composition from Project #7. It will be necessary for you to do the following things:

1. Decide which instrument is to play your melody. You may wish to change instruments for the melody line. You may wish to double the melody in two or more instruments and in two or more octaves.

2. Decide which instrument(s) will play each of the harmony lines. You may want like instruments, such as violin, viola, 'cello for the different lines, or you may wish to mix colors such as flute, trumpet, piano, and bassoon. You may wish to change colors in the accompaniment at the half-way point.

3. Once the above decisions are made, make a full-score copy of the entire composition. On it you must show the following:

   a. The tempo (very slow, slow, moderate, fairly fast, fast).
   b. The dynamic, or loudness, levels for each instrument. You probably will want to mark the solo line for stronger levels than the block of accompaniment sound.
   c. The correct notes for players who have transposing instruments such as trumpet or French horn, and the proper clef for viola, if you use them.
   d. Since this is a first experience with scoring, use as few instruments as possible, still trying to get the effect you want.

4. Once your score is completed, it is then necessary to write individual parts for each player. As these parts will be only a couple of lines in length, write several on one staff page, with your name and the name of the instrument on each part. We will cut them apart for distribution.
APPENDIX B.

Test of Musical Understanding
TEST OF MUSICAL UNDERSTANDING

NAME: __________________________ AGE: ________ GRADE: ________

Do you play in the school band or orchestra? ________
If so, what instrument(s) do you play? ________
How many years have you played? ________

Do you sing in a school choral group? ________
How many years have you sung in the group? ________

If you are taking or have taken private music lessons, list the instrument or voice and the number of years of lessons.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Years of lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

About how many minutes each day do you listen to music?

Do you listen to Popular Music? _____ Minutes/day _____
Do you listen to Classical Music? _____ Minutes/day _____
TEST OF MUSICAL UNDERSTANDING

Directions:

For the exercises below there are two columns of musical terms and symbols. You will find that the terms and symbols in the left column are in some way related to each other. All but three of the terms and symbols in the right column are related in the same way. Draw a line through the three unrelated terms or symbols in the right column.

Example:

<table>
<thead>
<tr>
<th>flute</th>
<th>trumpet</th>
</tr>
</thead>
<tbody>
<tr>
<td>clarinet</td>
<td>accented note</td>
</tr>
<tr>
<td>castanets</td>
<td>snare drum</td>
</tr>
<tr>
<td>slap-stick</td>
<td>vivace</td>
</tr>
<tr>
<td></td>
<td>crescendo</td>
</tr>
<tr>
<td></td>
<td>violin</td>
</tr>
<tr>
<td></td>
<td>triangle</td>
</tr>
</tbody>
</table>

Each of the terms in the left column (flute, clarinet, castanets, and slap-stick) names an instrument on which a sound may be made.

A trumpet is a sound-making instrument. You should draw a line through accented note since it is not an instrument. A snare drum is an instrument. Vivace is a term meaning that the music should be played in a lively style. You should draw a line through it. A crescendo is an increase in loudness and should have a line drawn through it. A violin and a triangle are both sound-making instruments.

This part of the test has 6 exercises. Be sure that you draw a line through three terms in each exercise. You have 10 min. for this part of the test. You may turn the page and begin.
Exercise 1

\textit{sfs}  
\textit{pianissimo}  
\textit{loud}  
\textit{ff}  
\textit{softly}  
\textit{fp}  
\textit{accelerando}  
\textit{pp}  
\textit{ppp}  
\textit{largo}  
\textit{forte}  
\textit{slowly}

Exercise 2

C\#  
key note  
440 vibrations per second  
concert D  
A\textsuperscript{b}  
tonic  
flute  
double reed  
accent  
middle C  
F

Exercise 3

quarter note  
\(\ddot{\text{J}}\)  
whole note  
\(\dddot{\text{E}}\)  
half rest  
\textit{sfs}  
concert A  
\(\dddot{\text{j}}\)  
sixteenth note  
\(\dddot{\text{l}}\)  
clarinet

Exercise 4

chord  
key of G  
C major scale  
quartal structure  
pentatonic scale  
written F  
viola

\begin{align*}
\text{accent} \\
\begin{array}{c}
\text{viola} \\
\text{accent}
\end{array}
\end{align*}
Exercise 5

allegro
accelerando
3
4
fast

Exercise 6

choir
symphonette
woodwind quintet
percussion ensemble

band
loud sound
xylophone duet
brass choir
trumpet
orchestra
soprano

STOP!!
Go back and check your work.

Do not turn the page.
Be sure that you have crossed out three terms for each exercise.
Directions:

Listen to the following exercises. You will hear them only once. Each exercise is in two parts. You are to determine if the second part is the same or different from the first part. If it is the same, draw a circle around the letter S. If it is different, draw a circle around the letter D. You are to mark every exercise. If you are not sure guess.

Example 1
S D
Since both parts were the same, circle the S.

Example 2
S D
Since the second part was different, circle the D.

Exercise 1          S D
Exercise 2          S D
Exercise 3          S D
Exercise 4          S D
Exercise 5          S D
Exercise 6          S D
Exercise 7          S D
Exercise 8          S D
Exercise 9          S D
Exercise 10         S D
Exercise 11         S D
Exercise 12         S D

Be sure that you have marked each exercise.
Part III

Directions:

When a composer writes music, he does certain things with the tones that we might call musical processes. He might repeat a series of notes exactly, or change one or more of the tones according to a certain plan. He might change the rhythm of the note pattern, or even write the notes in the reverse order. These are just a few of the musical processes possible.

Each exercise is in 4 parts. Parts 1 and 2 are related to each other through some musical process. Parts 3 and 4 are also related to each other through some musical process. You are to determine whether parts 3 and 4 are related by the same or different musical process as parts 1 and 2. If it is the same musical process, circle the S. If it is a different musical process, circle the D. If you are not sure -- guess. You will hear each exercise twice.

Example 1

\[\begin{align*}
\text{Part 1} & : \quad \text{Part 2} \\
\text{Part 3} & : \quad \text{Part 4}
\end{align*}\]

Since parts 3 and 4 were related by the same musical process as parts 1 and 2, circle the S. (4 exactly repeats 3, just as 2 repeats 1)

Example 2

\[\begin{align*}
\text{Part 1} & : \quad \text{Part 2} \\
\text{Part 3} & : \quad \text{Part 4}
\end{align*}\]

Since parts 3 and 4 were related by a different musical process than were parts 1 and 2, circle the D. (4 changes rhythm from 3, but 2 exactly repeats 1)
You will see and hear exercises 1 - 6. You will hear each exercise twice.

Exercise 1

Exercise 2

Exercise 3
Exercise 4

Exercise 5

Exercise 6
You will only hear exercises 7 - 12. You will hear each exercise twice.

Exercise 7  S  D
Exercise 8  S  D
Exercise 9  S  D
Exercise 10 S  D
Exercise 11 S  D
Exercise 12 S  D

You will only see exercises 13 - 18. You have 6 minutes in which to answer these 6 exercises. Begin now.

Exercise 13

Exercise 14

S  D
APPENDIX C.

Analysis of Covariance

According to Ostle (7:339) the proper F ratio for testing the hypothesis that there are no differences among the true effects of the t treatments on the Y variable after adjusting for the effect of the X variable is

\[ F = \frac{(S_t + E - S_e)/(t-1)}{S_e/(\sum_{i=1}^{t} n_i - t - 1)} = \frac{(S_t + E - S_e)/(t-1)}{S_e^2} \]

with degrees of freedom \( v_1 = t - 1 \) and

\[ v_2 = \sum_{i=1}^{t} n_i - t - 1. \]
Table 1
Analysis of Covariance for Test Scores and Mental Ability Scores of Groups 1 and 2

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
<th>d.f.</th>
<th>Mean Square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\Sigma x^2$</td>
<td>$\Sigma xy$</td>
<td>$\Sigma y^2$</td>
<td>$\Sigma y^2 - (\Sigma xy)^2 / \Sigma x^2$</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>171.480</td>
<td>372.1100</td>
<td>807.4900</td>
<td>...</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>173</td>
<td>28472.720</td>
<td>3201.0100</td>
<td>3329.7900</td>
<td>2969.9205</td>
</tr>
<tr>
<td>Total</td>
<td>174</td>
<td>28644.200</td>
<td>3573.1200</td>
<td>4137.2800</td>
<td>3691.5638</td>
</tr>
</tbody>
</table>

Difference for testing adjusted treatment means

<table>
<thead>
<tr>
<th>$F = 41.7932$</th>
</tr>
</thead>
</table>

$\text{Beta} = .1124$
Table 2.
Analysis of Covariance for Test Scores and Mental Ability Scores of Groups 3 and 4

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\sum x^2$</td>
<td>$\sum xy$</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>25,8000</td>
<td>-65,4100</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>64</td>
<td>5873,7000</td>
<td>583,2300</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>5899,5000</td>
<td>517,8200</td>
</tr>
</tbody>
</table>

Difference for testing adjusted treatment means 178,4001 1 178,4001

$F = 14.4075$

Beta = .0992
Table 3.
Analysis of Covariance for Test Scores and Years of Performance of Groups 1 and 2

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\sum x^2$</td>
<td>$\sum xy$</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>410,6094</td>
<td>575,8160</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>173</td>
<td>2659,1049</td>
<td>1071,5840</td>
</tr>
<tr>
<td>Total</td>
<td>174</td>
<td>3069,7143</td>
<td>1647,4000</td>
</tr>
</tbody>
</table>

Difference for testing adjusted treatment means  
$355.2267$  
1  
$355.2267$

$F = 21.0834$

Beta = .4029
Table 4.
Analysis of Covariance for Test Scores and Years of Performance of Groups 3 and 4

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( \sum x^2 )</td>
<td>( \sum xy )</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>674,149</td>
<td>105,7676</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>64</td>
<td>200,3426</td>
<td>79,1112</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>267,7575</td>
<td>184,8788</td>
</tr>
<tr>
<td>Difference for testing adjusted treatment means</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( F = 5.4292 \)

\( \text{Beta} = .3948 \)
Table 5.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>( \sum X^2 )</th>
<th>( \sum X )</th>
<th>( \sum X^2 )</th>
<th>( \sum X Y )</th>
<th>( \sum X Y^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>174</td>
<td>450,279</td>
<td>411,9862</td>
<td>576,7800</td>
<td>807,4900</td>
<td>172</td>
<td>15,1762</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>2660,8710</td>
<td>4137,2800</td>
<td>3576,5906</td>
<td>3576,5906</td>
<td>173</td>
<td>450,2794</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>173</td>
<td>3072,8572</td>
<td>1732,6000</td>
<td>3576,5906</td>
<td>3576,5906</td>
<td>173</td>
<td>450,2794</td>
</tr>
</tbody>
</table>

\( F = 24.7729 \)

\( \beta = 0.2765 \)
Table 6.
Analysis of Covariance for Test Scores and Years of Private Lessons for Groups 3 and 4

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\sum x^2$</td>
<td>$\sum xy$</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>20.2230</td>
<td>57.9293</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>64</td>
<td>268.3981</td>
<td>88.2223</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>288.6212</td>
<td>146.1516</td>
</tr>
<tr>
<td>Difference for testing adjusted treatment means</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$F = 9.4172$

$\beta = .3286$
Table 7.
Analysis of Covariance for Test Scores and Daily Minutes of Listening for Groups 1 and 2

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\Sigma x^2$</td>
<td>$\Sigma xy$</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>83433.3</td>
<td>-8208.040</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>173</td>
<td>1109252.5</td>
<td>5514.070</td>
</tr>
<tr>
<td>Total</td>
<td>174</td>
<td>1192685.8</td>
<td>-2693.970</td>
</tr>
<tr>
<td>Difference for testing adjusted treatment means</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$F = 43.1677$

$\text{Beta} = .0049$
Table 8.
Analysis of Covariance for Test Scores and Daily Minutes of Listening for Groups 3 and 4

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares and Products</th>
<th>Deviations About Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\sum x^2$</td>
<td>$\sum xy$</td>
</tr>
<tr>
<td>Among Treatments</td>
<td>1</td>
<td>5366.69</td>
<td>-943.690</td>
</tr>
<tr>
<td>Within Treatments</td>
<td>64</td>
<td>332336.41</td>
<td>-60.550</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>337703.10</td>
<td>-1004.24</td>
</tr>
<tr>
<td>Difference for testing adjusted treatment means</td>
<td></td>
<td>162.9638</td>
<td></td>
</tr>
</tbody>
</table>

$F = 12.2516$

Beta = -.0001
APPENDIX D.

Calculation of Adjusted Means
Table 1.
Calculation of Adjusted Means for Test Scores of Groups 1 and 2 from Mental Ability Scores

<table>
<thead>
<tr>
<th>Total Mean of Mental Ability Scores</th>
<th>44.5942</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Test Scores</td>
<td>37.7200</td>
</tr>
<tr>
<td>Beta</td>
<td>.1124</td>
</tr>
<tr>
<td>Mean of Mental Ability Scores</td>
<td>47.3500</td>
</tr>
<tr>
<td>Mean of Mental Ability minus Mean of Total Mental Ability</td>
<td>2.7558</td>
</tr>
<tr>
<td>Beta times Mean of Mental Ability Scores</td>
<td>.3097</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>43.7000</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>43.3920</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>.9316</td>
</tr>
</tbody>
</table>
Table 2: Calculation of Adjusted Means for Test Scores of Groups 3 and 4 from Mental Ability Scores

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Mental Ability Scores</td>
<td>122.5833</td>
<td>124.2037</td>
</tr>
<tr>
<td>Mean of Mental Ability Scores minus Mean of Total Mental Ability</td>
<td>-1.3256</td>
<td>.2947</td>
</tr>
<tr>
<td>Beta times Mean of Mental Ability Scores</td>
<td>-.1315</td>
<td>.0292</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>41.3333</td>
<td>37.2222</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>41.4648</td>
<td>37.1929</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>1.0176</td>
<td>.4790</td>
</tr>
</tbody>
</table>
Table 3.
Calculation of Adjusted Means for Test Scores of Groups 1 and 2 from Years of Music Performance

<table>
<thead>
<tr>
<th>Total Mean of Years of Music Performance</th>
<th>3.8857</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Test Scores</td>
<td>37.7200</td>
</tr>
<tr>
<td>Beta</td>
<td>.4029</td>
</tr>
<tr>
<td><strong>Group 1</strong></td>
<td><strong>Group 2</strong></td>
</tr>
<tr>
<td>Mean of Years of Music Performance</td>
<td>8.1500</td>
</tr>
<tr>
<td>Mean of Music Performance minus Mean of Total Music Performance</td>
<td>4.2643</td>
</tr>
<tr>
<td>Beta times Mean of Years of Music Performance</td>
<td>1.7180</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>43.7000</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>41.9819</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>.9785</td>
</tr>
</tbody>
</table>
Table 4.
Calculation of Adjusted Means for Test Scores of Groups 3 and 4 from Years of Music Performance

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Years of Music Performance</td>
<td>1.9393</td>
<td></td>
</tr>
<tr>
<td>Total Mean of Test Scores</td>
<td>37.9696</td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>.3948</td>
<td></td>
</tr>
<tr>
<td>Mean of Years of Music Performance</td>
<td>4.0833</td>
<td>1.4629</td>
</tr>
<tr>
<td>Mean of Music Performance minus Mean of Total Music Performance</td>
<td>2.1440</td>
<td>-.4763</td>
</tr>
<tr>
<td>Beta times Mean of Years of Music Performance</td>
<td>.8464</td>
<td>-.1880</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>41.3333</td>
<td>37.2222</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>40.4868</td>
<td>37.4102</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>1.1666</td>
<td>.5016</td>
</tr>
</tbody>
</table>
Table 5. Calculation of Adjusted Means for Test Scores of Groups 1 and 2 from Years of Private Lessons

<table>
<thead>
<tr>
<th></th>
<th>Total Mean of Years of Private Lessons</th>
<th>Total Mean of Test Scores</th>
<th>Beta</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Years of Private Lessons</td>
<td>2.8285</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Mean of Test Scores</td>
<td>37.7200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>.2765</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group 1</td>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of Years of Private Lessons</td>
<td>7.1000</td>
<td>2.2774</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of Years of Private Lessons minus Total Years of Private Lessons</td>
<td>4.2715</td>
<td>-.5510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta times Mean of Years of Private Lessons</td>
<td>1.1810</td>
<td>-.1523</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>43.7000</td>
<td>36.9483</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>42.5189</td>
<td>37.1007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>1.0165</td>
<td>.3454</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Calculation of Adjusted Means for Test Scores of Groups 3 and 4 from Years of Private Lessons

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Years of Private Lessons</td>
<td>3.2500</td>
<td>1.8148</td>
</tr>
<tr>
<td>Mean of Years of Private Lessons minus Total Mean of Years of Private Lessons</td>
<td>1.1743</td>
<td>-0.2608</td>
</tr>
<tr>
<td>Beta times Mean of Years of Private Lessons</td>
<td>0.3858</td>
<td>-0.0857</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>41.3333</td>
<td>37.2222</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>40.9474</td>
<td>37.3079</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>1.0658</td>
<td>0.4909</td>
</tr>
</tbody>
</table>
Table 7.
Calculation of Adjusted Means for Test Scores of Groups 1 and 2 from Daily Minutes of Listening

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Daily Minutes of Listening</td>
<td>62.5000</td>
<td>131.1290</td>
</tr>
<tr>
<td>Total Mean of Test Scores</td>
<td>43.7000</td>
<td>36.9483</td>
</tr>
<tr>
<td>Mean of Daily Minutes of Listening</td>
<td>-60.7857</td>
<td>7.8433</td>
</tr>
<tr>
<td>Beta times Mean of Minutes of Listening</td>
<td>.2978</td>
<td>.0384</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>43.9978</td>
<td>36.9099</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>1.0119</td>
<td>.3534</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8.
Calculation of Adjusted Means for Test Scores of Groups 3 and 4 from Daily Minutes of Listening

<table>
<thead>
<tr>
<th></th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean of Daily Minutes of Listening</td>
<td>107.8787</td>
<td></td>
</tr>
<tr>
<td>Total Mean of Test Scores</td>
<td>37.9696</td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>-.0001</td>
<td></td>
</tr>
<tr>
<td>Mean of Daily Minutes of Listening</td>
<td>88.7500</td>
<td>112.1296</td>
</tr>
<tr>
<td>Mean Minutes of Listening minus Mean of Total Minutes of Listening</td>
<td>-19.1207</td>
<td>4.2509</td>
</tr>
<tr>
<td>Beta times Mean of Minutes of Listening</td>
<td>.0019</td>
<td>-.0004</td>
</tr>
<tr>
<td>Mean of Test Scores</td>
<td>41.3333</td>
<td>37.2222</td>
</tr>
<tr>
<td>Mean of Adjusted Test Scores</td>
<td>41.3314</td>
<td>37.2226</td>
</tr>
<tr>
<td>Standard Error of the Adjusted Test Scores</td>
<td>1.0597</td>
<td>.4970</td>
</tr>
</tbody>
</table>
Literature Cited


5. Mills, Donn "Teach Composition In Your General Music Class" *Music Educators Journal*. Volume 49, Number 5 April-May 1963

