MEASUREMENT OF THE SIGHT READING ABILITY OF SPECIAL PUBLIC SCHOOL MUSIC STUDENTS IN INDIANA TEACHER EDUCATION INSTITUTIONS

by

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I. INTRODUCTION

The investigation reported in this monograph was made in the effort to devise a means for testing the success of public school music departments of Indiana Teacher training schools in training future music teachers in musicianship. Sight reading skill was chosen as the particular phase to receive attention.

A. The Conditions of the Problem

The music department of the present day teachers college and the public school music department of the conservatory have at least two duties to perform for their students. They must give these young men and women opportunities to advance and improve as musicians, and they must provide experiences and the opportunities to acquire knowledges which will aid in fitting them as teachers of music in the grades and the high schools.

It is generally observed that most of the students bring only a moderately advanced equipment of musical skills and knowledges to these schools. It requires, it has often been said, not less than eight years of intensive training to produce a capable musician. If that is also true of the musician who is preparing for public school music teaching, then these students should bring with them four years of sound musical preparation as the basis for their further training. That that is seldom the
case, few would care to deny, although objective evidence is lacking. At any rate, all of these music departments give evidence of the belief that further training in musicianship is an essential part in the course of training by requiring attendance in classes of theory and practical instrumental work, classes which have as their primary goal skills and knowledges of the conservatory type.

The attention of the cultured and highly trained musician has been drawn to public school music by its very rapid growth in popularity. He has recognized its great possibilities for creating larger and more appreciative audiences for his concerts, and has not been hesitant in criticizing inferior music and poorly trained teachers of public school music. Furthermore, members of his group have been drawn into school music by the demand for teachers during the last decade. In turn, they have aided in creating a demand for teachers of higher musical ideals, of superior musicianship. All of these forces have exerted constantly increasing pressure on the public school music department, requiring that it prepare and graduate students with sound musical training. To what extent it succeeds is a matter of genuine import.
B. Selection of the phase to be Investigated

To throw some light on this question is the avowed intention of this report. Since any treatment of the whole problem would require not one but many investigations, the immediate need is to limit the problem to one phase, small enough to be feasible for investigation, but sufficiently large to give hope of reflecting the conditions now obtaining. It seems reasonable to believe that one large and general phase of musicianship, required of all musicians, possessing certain general standards of attainment, and offering opportunity for objective measurement might be chosen for investigation. Even if the investigation of this one phase should not provide a picture of the whole forest, it might provide a view of a few trees, a view that might have some value. One phase of musicianship which seems to meet the criteria set up is that known to the musician as sight reading skill. To gain a picture of the sight reading skill of special music students in Indiana is the specific purpose of this investigation.

C. Nature and Importance of Sight Reading Skill

The attainment of sight reading skill calls for the mastery, often great over-learning, of the common problems met when interpreting musical symbols to the end that immediate, automatic response may be made to much material when read for the first time. Although these common
problems, better known as idioms, are met again and again, they often occur in a manifold number of variations, a great variety of settings. Not only must those basic idioms be mastered, but sufficient use be made of them under different conditions so that a sort of generalized control of the idiom shall result. To illustrate—one common rhythmic problem or idiom consists of mixed quarter and eighth notes in two-four measure. If a student can respond rhythmically to that problem when the melody tones are in simple scale form, that is no indication that he will respond accurately when the melody tones describe odd or unusual tonal patterns. If he does not respond accurately under the latter condition, he has not sufficiently mastered that rhythmic idiom. If he does it is probable that mastery has been attained.

Mastery of many common idioms and ability to use them under a great variety of conditions are generally regarded by musicians as necessary for efficient musical performance. The person who interprets musical notation slowly, hesitantly, and uncertainly is as incompetent as one who has not progressed beyond the third grade degree of reading skill. A member of a symphony orchestra must be able to read very difficult and complex passages at sight. The soloist who spends much time in working out the exact meaning of the musical notation has consumed much time that might better have been devoted to interpretative matters. Similarly, the director of orchestra, band, chorus, or glee club must be an efficient sight-reader so that he may be quick and accurate in the interpretation of musical notation, and so
that his time may be saved for the many other necessary duties of his profession. Only one who can read well at sight can learn new music efficiently.

That such skill is necessary is universally recognized. Every music school requires that students attend certain courses designed to develop skill, accuracy, and speed in interpreting musical notation. These courses are usually vocal on the theory that the vocal response puts the minimum of obstruction between the mental activity and the audible evidence of that activity. Furthermore, it is universally recognized that the mental recognition of the content of a musical passage, whether to be interpreted by voice or instrument, is an absolute essential to truly musical performance. The courses based on these theories are designed to develop the large and undefinable thing known as musicianship which includes the more specific phase known as sight reading ability. Further evidence of the general acceptance of the need for sight reading ability is to be observed in a recent development in national, state, and district band and orchestra contests. Many judges now require that organizations demonstrate a definite degree of ability to read at sight. Failing to demonstrate this, the organization is automatically rated lower than the ranking earned through the performance of prepared compositions. This penalizes the group which has devoted its attention exclusively to the mastery of a very limited group of compositions, and rewards the group which may not have
performed the set numbers better but which does demonstrate a better equipment in sight reading skills.

The writer must enter one caution at this point. The development of skill in reading music at sight is not the prime objective of music study. It is a means only. Tonally beautiful, emotionally vital musical performance must be the chief goal in all training. Adequate control must be had over the basic elements of pitch and rhythm. They are the materials which are to be molded to the goal. In the handling of these subordinate but all important elements lies the province of sight reading skills. Those skills give efficiency in their manipulation and are therefore only a means to an end, but a very important one.

D. The Questions for which Answers are Desired

How well do typical Indiana Schools having public school music departments succeed in developing skill at reading music at sight? This is the central problem set for this investigation. An effort will be made to give a partial answer to the question by indicating representative successes and failures on frequently used musical idioms.

Attendant problems are—to what extent does the study of different instruments or mediums of musical expression such as the voice, the violin, the piano, or brass instruments, and the courses of study for these, affect the attainment in sight reading? How much does senior college instrumental study affect the sight reading ability over that obtained in the junior college ear training?
Other questions are--what relation does intelligence have to sight reading skill? Are those students of higher musical talent proportionately superior to those of less talent?

Finally, by what means shall a measure of skill in reading music at sight be obtained? Although listed last, this question must receive initial attention. The efforts made to develop such a means of measurement will be discussed in the next section of this report.
II. METHOD OF ATTACK

A. Need for a Suitable Test

Mosher\(^1\) in an excellent investigation demonstrates conclusively that the several group tests labeled sight-singing tests are either invalid or of low reliability. He used seven types of tests, correlating them with a criterion consisting of an actual vocal test. A reliability coefficient of .65 was obtained, which is entirely inadequate. It is immediately evident that the group tests, even if there were any available for college majors, would be undesirable for the purpose of this investigation. The problem of measuring skill in sight reading cannot as yet at least be measured indirectly. Only an individual test calling for a response to unfamiliar music under conditions similar to those met in actual music reading gives any promise of meeting the requirements of this problem.

Only two sight reading tests are available. One is by Hillbrand\(^2\) and is intended for fourth, fifth, and sixth grade children. The other is by Otterstein and Mosher\(^3\) and is intended, apparently, for high school students and college minors. Neither of these meet the requirement of this problem, both being much too easy to test college majors. Therefore it was necessary to build an original test.

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B. Assumptions Necessary

Certain questions being unanswered, it was necessary to set up certain reasonable assumptions, build the test on that basis, and then endeavour to use test results in the effort to gain proof of their validity.

The principal assumptions are as follows.

1. As far as can be determined at present, the only safe method of testing ability in reading musical symbols is by means of individual tests on material representative of every day problems in music reading.

2. Instrumentalists are able to sing sufficiently well for test purposes what they are really able to read. It is possible that vocalists may have some little advantage over instrumentalists in greater flexibility of vocal action particularly where speed is a factor. It must be observed, however, that all the subjects tested but one had had one year or more of ear training or sight singing, in which classes vocal responses were constantly required. It is to be regretted that too few vocal majors were found to set up a case for or against this assumption.

3. Music students in training for teachers need not be distinguished from other music students in the matter of selecting test items; that is, no specific factors are present in their training different from those in the training of other music students requiring that different test material be used to measure them.
4. Since no objective evidence is available as to the common idioms of music, it was decided that a rather random selection of melodies reflecting the general musical problems encountered by all musicians would have to suffice as a starting point. It will be seen later that many safeguards were thrown around this step.

These assumptions seem reasonable in the light of experience in music teaching.

C. The Factors of Musicianship to be Included

Analysis of the general types of problems involved in music reading disclose some seven types or factors. They are as follows.

1. Recognition of the key signature and its implications for the given melody.
2. Recognition of the measure signature and its effect on the melody.
3. Recognition of and ability to interpret rhythmic figures.
4. Recognition of the problems of tonality in their many manifestations and power to use the sense of tonality.
5. Speed in response.
6. Recognition of the demands of the musical passage as to kinds and qualities of tone.
7. Recognition of phrase outlines and other matters of form.
There can be no doubt as to the first five. They are essential to the interpretation of musical symbols and must be considered in any test. The fourth factor, that of tonality might be considered from many angles, and is so considered in formal courses in ear training and sight singing, but it was decided to leave it as one large factor only so that scoring might be made as simple as possible. The sixth factor, that of quality of tone, is not usually accepted as a problem of sight reading and was discarded. The seventh one, that of form of composition, is undoubtedly an important factor in music. However, later decisions as to the length of test items and the need for keeping scoring as simple as possible led to the decision to discard it, or rather to equate it in each example and give it no farther attention.

One other factor, that of kinesthetic control of muscular action, received consideration. While of the utmost importance in instrumental performance and indeed present in the tensing and relaxing of the vocal organs, it was discarded as a special factor as having received consideration in the second assumption given above.

D. Grades of Difficulty of Each Factor

Having settled tentatively on the factors to be considered, attention was given to the effort to divide these factors into grades of difficulty. Following are the grades settled upon as a starting basis. Grade 1 may be
considered as easy; grade 2 as of moderate difficulty; and grade 3 as of genuine difficulty.

1. Key signature.
   (1) Very familiar keys.
   (2) Less commonly used keys, or keys considered more difficult.

2. Measure signature.
   (1) Common or easy.
   (2) Common but considered more difficult, and those infrequently used but considered easy.
   (3) Used infrequently and considered difficult.

3. Rhythmic figures.
   (1) Those involving ratios of 1:1, 1:2, 1:3, and considered easy.
   (2) Those involving ratios of 1:4, 1:6, 1:8, 2:3, and rather easy mixed examples.
   (3) Unusual ratios such as 3:4, 1:5, 1:7, and greatly mixed figures.

4. Tonalities.
   (1) Examples using common tonal patterns, involving common chords and simple modulations to closely related keys.
   (2) Less usual patterns, involving secondary chords and less related keys in modulations.
   (3) Very odd or strikingly unusual patterns.

5. Speed.
   (1) Tones at a rate of speed up to 119 per minute.
   (2) Tones at a rate of speed from 120 to 239 per minute.
(3) Tones at a rate of speed of 240 and up per minute.

E. Validation of the Decisions Made

Although based on some twenty years of experience in music and considerable thought given to the problem, the fact remains that the grades represent a single judgment only. So, two piano teachers who have received considerable recognition as capable instructors in sight reading skills, three heads of public school music departments in Indiana, one very capable Ph. D. in one of the music departments, and the supervisor of the largest school system in Indiana who has taught sight singing courses, were asked to indicate their opinions as to the conclusiveness of the list of factors and the adequacy of the grades set up.

They were asked to check the following scale.

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<th>Satisfactory</th>
<th>Adequacy Doubtful</th>
<th>Inadequate</th>
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<tbody>
<tr>
<td>Key Signature</td>
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<tr>
<td>Measure Signature</td>
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<td>Rhythm</td>
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<td>Tonality</td>
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<tr>
<td>Speed</td>
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<tr>
<td>Conclusiveness of this list</td>
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Comments on unfavorable reports were asked for.
Six indicated that the grades of the first three factors were satisfactory in their opinion. One thought two grades were sufficient.

There was unanimous agreement as to tonality.

Six accepted the speed grades. One indicated doubt as to their adequacy but made no comment.

Four indicated that in their opinion the list was satisfactorily conclusive. One of these pointed out the failure to measure "interpretation and phrasing," and then continued, "but in so far as it goes I consider it valid."

Two failed to check this item, but indicated satisfaction in their comments. One wished that phrasing and muscular sense of distance might be considered. Reasons for the non-inclusion of these additional factors or their equation as between test items have already been given.

On the whole, the verdict was decidedly favorable.

It is interesting to note that only one member of the jury disagreed with the grades of speed and disappointing that he made no comment. The decision as to grades of speed was the only arbitrary one of the five and might have received much criticism. It requires some discussion. Lacking any objective knowledge as to which speeds are comfortable, which are uncomfortable, and which are genuinely difficult for such students as were to be tested, it was decided to set up arbitrary ranges based on the German "Takt." This is the theory that the human, because he is a being of a certain size, responds most naturally
at a certain general range of speed. If he were smaller, his natural speed response would probably be faster; if he were larger, it would probably be slower. The exponents of this theory, which has a good deal of justification, believe that the speeds of about 60 to 80 beats per minute are the most natural ones.\(^4\) Although the subjects to be tested were selected, it was thought that the speed of 80 tones per minute could be accepted tentatively as very easy, 160 per minute as of moderate difficulty, and 320 per minute as of great difficulty. Then an effort might be made to arrange the test in such a manner as to get proof or disproof of these assumptions. We may then consider this a fifth assumption to be checked in the results of the test.

F. Novelty of the Items

One other matter was considered before the actual construction of the test was begun; namely, novelty of items.

Obviously, musical phrases or melodies which are known by the student and which he has memorized will not test his ability to "sight read". The criterion in the building of intelligence tests is to select items which will be of equal novelty to the subjects. That is, taken "by and large", few if any of the items should be familiar to the subjects.

It seemed necessary, then, to go to material that is quite remote from the experience of the average music student, vocal and instrumental, obtain a large number of items, and have professional musicians of wide experience check these melodies indicating those that are familiar to them. These could then be discarded, or several minor changes made, so as to reduce the possibility of the subject drawing directly on his memory.

Possible sources are as follows;

Seldom used music of the early centuries.
Older, unused symphonic music.
Unperformed operas.
Very recent, unpublished compositions.

It may be pointed out that no student gave any indication of recognition of any of the melodies ultimately chosen on this basis.
III. CONSTRUCTION AND ADMINISTRATION OF THE TEST

A. Selection of the Test Items

Having set up a set of criteria for the selection of test items and gained the acceptance of a jury of "experts" of the criteria, the actual construction of the test was undertaken.

One hundred eight measure melodies were drawn at random from many sources. These items were carefully graded on the basis that has been described, and checked by three capable musicians for familiarity. Of these melodies, all but eighteen were discarded. Each melody retained contained one or more problems distinctly different from those found in the remaining melodies. Each grade of each factor was represented somewhere in the eighteen melodies or the ten additional variants to be described later. The possible number of combinations that might be obtained from five factors in three grades is of course much greater than the twenty-eight of the completed test, but it was clearly out of the question to use every possible combination. However, it is believed that a fair sampling of musical problems appear in the test, and this sampling theory is set up as a defense of the procedure observed. The melodies are given in the appendix.

Four of the eighteen melodies were chosen for experimental purposes. One, an old Bohemian choral, was used in an attempt to measure speed. Three variations were written, one in eighth notes, one in triplet eighths, and the other
in sixteenths. Tonality problems were maintained as nearly fixed as possible. A measure signature of four-four was used in the first variation and the theme, and two-four measure in the other two variations. The net result is that the subjects are required to respond at four speeds in the ratio of one, two, three, and four. See melodies 2, 7, 12, and 16.

The second melody chosen for experiment contained some chromatic tones and an abrupt modulation. Two variations were written, one easier than the theme, and one more difficult. As in the case of the other experimental melody, speed is the factor that is varied. See melodies 4, 11, and 19.

In the case of the third melody chosen for this purpose, three variations were written, and an effort made to scale speed and rhythm. See melodies 3, 14, 21, and 24.

The fourth experimental melody is a very difficult one. Again an effort was made to scale speed in the two variations which were written. The actual result was markedly different as will be described later. See melodies 13, 15, and 27.

B. Grading the Items

The sum of the grades on each factor as applied to each melody gave a rough index as to the difficulty of the item. So the melodies were arranged in order from easy to difficult, care being taken to separate any two variants of a particular experimental melody to reduce the possibility of memory aiding the subject.
The test melodies were written on a master sheet for the tester and on small cards for the subject.

Each melody was then memorized by the tester so that an approach might be made to infallibility in testing. Then, that tempo which was distinctly natural for each melody and comfortable for the tester was determined. Note that a tempo which was comfortable for the tester, who had memorized the melodies, is distinctly different from that which might be comfortable for a subject when reading and responding to the notation at sight. To be sure that no completely impossible tempo was called for, the tester's tempos were reduced slightly. The metronome speed was indicated clearly on each card and on the master sheet.

C. Conditions Under Which the Test Should Be Given

The next step consisted of determining the conditions under which the test should be administered. A tentative scheme was worked out. Then an experimental group of ten subjects, ranging from capable high school students to professional music teachers, were given the test and asked to make comments and point out errors and ambiguities. On this basis the following directions and general scheme of administration was settled upon.

Directions to be read by examiner.

"This is a test in the reading of music at sight.
"You are asked to sing a number of eight measure melodies. You may use syllables, 'loo', or any other sound you may wish."
"These melodies will be in different keys, so the tone, 'do', will be sounded for each one. Notice that some of the melodies may be in minor, but that will make no difference. Only 'do', the key tone in the major key, will be sounded.

"Then, these melodies are in different tempos, so the beat will be given by the metronome for each one.

"Endeavour to sing the melody as accurately as you can at the tempo given. Don't slow down, don't stop, unless absolutely necessary.

"Let us follow this routine. When the test card is disclosed, I shall sound 'do'. Listen carefully to the tone of the pitch pipe. Then glance carefully but quickly through the melody. You will be allowed six seconds for inspection. Then I shall sound 'do' again, and set the metronome in action. As soon as you are certain of the speed, sing.

"Here are some sample melodies which we shall sing so you may be certain of what you are asked to do. (Two samples were sung.)

"Now, if you are certain of the routine, we shall begin the test. Turn each card over as soon as you have sung the melody. We shall not pause between melodies."

The test was given at a table with the subject placed to the left of the examiner. The metronome was placed between the two so as to partially shield the examiner's score sheet in order that distraction to the subject might be reduced.
It is believed that the subjects taking this test were placed under conditions for all essential purposes like that under which they actually read music at sight. Only a short period of time was allowed for inspection, no measure signature was interpreted, no indication of pulsation given. All essential information was given on the test card, only the tempo and the key tone being given by the examiner. In actual practice, the musician would get the tempo from the conductor and the pitch from an instrument, either his own or one which accompanies him. The conditions were stringent, but equally fair. No one failed to understand the conditions of the test.

D. Method of Scoring the Test

The test was scored as follows. A transparent sheet of paper was placed over the examiner's copy of the test in a precise manner on the page. Thus the melody might be read through the paper and the sheet returned to its proper place on the master sheet at a later time for any further treatment necessary.

Two scores were indicated by means of dashes. If any measure was sung incorrectly as to pitch, a dash was made over the measure. If any error or errors were made in rhythm in any measure, a dash was made under the measure. If the subject began in the wrong key, a cross was made over the clef, showing failure to interpret the key signature properly. If he clearly indicated a misinterpretation of
the measure signature, a cross was entered under the clef. The same sign was used if he failed from the first measure onward to maintain the set speed. A little leeway in speed was allowed, but if the tempo was sharply reduced there was nothing else to do but indicate a complete failure. However, this is felt to have been a weak spot in the scoring. Some other symbol should have been used to indicate that failure.

It is interesting to note that the Otterstein-Mosher test allows the subject to set his own tempo. This seems indefensible. If one of two students interprets a given melody accurately at one tempo, and the other accurately but at a much slower tempo, it is clearly unfair to give the two the same rating. The scoring method used in this investigation differentiates between the two and penalizes the subject who cannot respond at a given tempo. The only alternative would be to throw out the response entirely. That, however, would be too great a penalty, since the subject may have control over the tonality problems at the slower tempo, and so deserves credit for that over the subject who is totally unable to solve, and respond, to the problems.

Use of the measure as the unit for scoring errors in rhythm and pitch requires defense. Hillbrand's Sight Singing Test, consisting of two eight measure melodies and four sixteen measure melodies, calls for a very complicated system of scoring. Nine types of errors are marked with as
many different symbols. That scheme may be practicable for scoring fourth, fifth, and sixth grade children. However, no tester could use it for college majors. That system would require that the examiner catch many errors, make many decisions, select the proper scoring device, and mark the errors, all in a period of about thirty seconds, the average length of the eight measure melodies used in this test. It is probable that no human being is that competent.

Mosher experimented with similar subjects using a system in which each tone was marked only on pitch and rhythm. Then he had many examiners score an individual simultaneously. Despite the fact that they were scoring grade school children, these examiners failed markedly in scoring alike. He then experimented with the measure as the scoring unit and found that objectivity was much greater. Salisbury and Smith also experimented with the two systems and chose the measure as the better unit.¹

It might be argued that use of the measure as the unit for scoring does not differentiate between a subject who makes one and possibly a trivial error in the measure and another who fails entirely in the same measure. On the other hand, the second subject almost certainly fails on several of the succeeding measures because of what is for him an unsurmountable difficulty. In contrast with him,

the first subject recovers instantly and makes no further errors which result directly from that one failure, with the one possible exception of a momentary disturbance in the tempo flow. No objective proof of this fact is available, but observation clearly demonstrates its truth.

On the whole, the evidence sharply favors the use of the measure as the scoring unit whenever rapid responses are to be scored. The only scheme that might seem to promise superiority is an impractical one. That would require the making of a permanent record of the response by some mechanical means, such as a phonograph or an adaptation of the tonoscope and some device for recording rhythm. The recorded response could then be studied in detail at leisure. Whether the advantages accruing from such a device would offset the expense is doubtful. The measure unit of scoring has faults and is by no means of perfect objectivity, but it is the best device as yet discovered.

As each melody contains eight measures, a student may score from 0 to 8 on pitch, from 0 to 8 on rhythm, and from 0 to 16 on the whole melody. However, a slightly different set of figures was obtained. The number of errors on pitch and on rhythm were obtained and the total score right inferred from those figures. The possible score right on the whole test ranges from 0 to 448. The errors in pitch on the whole test may range from 0 to 224. The range of rhythm errors may also be from 0 to 224.
E. Additional Data Obtained

Each subject filled out a sheet giving his name, age, sex, school, and class. He also listed his instruments and checked the amount of study on each as "little," "considerable," or "much." It is the writer's opinion that any finer distinction is indefensible. Differences in quality of instruction, amount of effort, and other factors make it undesirable to compare number of lessons, or months devoted to study. The subject also listed amount of vocal study in the same manner as for instruments.

Certain other facts to be mentioned later were obtained from school records.
IV. RESULTS OF GIVING THE TEST

The test was given to 113 public school music major students in three schools, Indiana State Teachers College, Arthur Jordan Conservatory of Music, and Ball State Teachers College. Table I shows their classification according to school standing.

TABLE I
CLASSIFICATION OF STUDENTS ACCORDING TO SCHOOL AND CLASS STANDING

<table>
<thead>
<tr>
<th>Schools</th>
<th>Fresh</th>
<th>Soph</th>
<th>Junior</th>
<th>Senior</th>
<th>Grad</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indiana State</td>
<td>8</td>
<td>19</td>
<td>15</td>
<td>26</td>
<td>6</td>
<td>74</td>
</tr>
<tr>
<td>Jordan</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Ball State</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>29</td>
<td>22</td>
<td>37</td>
<td>14</td>
<td>113</td>
</tr>
</tbody>
</table>

All but one of the freshmen had completed or practically completed one year of ear training and sight singing and should be classed as sophomores for the present investigation.

The essential data resulting from giving this test are as follows.

- Number of cases = 113
- Range of scores = 79 to 439
- Mean score = 260.7
- S. E. = 6.9
Standard deviation = 72.7  S. E. = 4.8

Median = 262.5

Quartile Deviation = 50.8

The distribution of scores is shown in Table II.

TABLE II

<table>
<thead>
<tr>
<th>Scores</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>425-448</td>
<td>2</td>
</tr>
<tr>
<td>400-424</td>
<td>1</td>
</tr>
<tr>
<td>375-399</td>
<td>3</td>
</tr>
<tr>
<td>350-374</td>
<td>9</td>
</tr>
<tr>
<td>325-349</td>
<td>4</td>
</tr>
<tr>
<td>300-324</td>
<td>15</td>
</tr>
<tr>
<td>275-299</td>
<td>16</td>
</tr>
<tr>
<td>250-274</td>
<td>12</td>
</tr>
<tr>
<td>225-249</td>
<td>14</td>
</tr>
<tr>
<td>200-224</td>
<td>13</td>
</tr>
<tr>
<td>175-199</td>
<td>10</td>
</tr>
<tr>
<td>150-174</td>
<td>7</td>
</tr>
<tr>
<td>125-149</td>
<td>4</td>
</tr>
<tr>
<td>100-124</td>
<td>2</td>
</tr>
<tr>
<td>75-99</td>
<td>1</td>
</tr>
</tbody>
</table>

Total  113
After fifty cases were obtained, the median was stationary. The mean varied from 257.5 to 262.0, a variation less than the standard error of the mean. Rather marked variance was observed in the standard deviation as the extreme cases were discovered, chiefly two girls at Arthur Jordan Conservatory of Music. One had absolute pitch and made an almost perfect score. The other was a negro girl who verged closely to musical illiteracy. These two scores raised the standard deviation nearly ten points. Later scores filled out the adjacent class intervals giving a fairly normal distribution. To reduce the standard error of the standard deviation to a figure close to 1 would require about 800 additional cases.

An adaptation of Pearson's formula for skewness was applied. $sk = \frac{3(M-M_d)}{\text{Stan. Dev.}} = -0.074$

It has been suggested that an index of ±.1 indicates moderate skewness, and ±.3 indicates marked skewness. What the figure -.074 means is doubtful, but it seems to indicate something less than "moderate skewness".

On the other hand, disregarding the extreme ranges and using the formula for the quartile coefficient of skewness, a smaller index is obtained. $\frac{Q_3 + Q_1 - 2M}{Q_3 - Q_1} = -0.037$

On the whole the distribution shows a strong tendency to assume the shape of the curve of normal probability.

These evidences lend strength to the belief that this group is a fair sampling of the public school music majors of these three schools.
The coefficient of reliability of the test taken between odd and even melodies and stepped up by the Spearman-Brown prophecy formula is .96. The means and standard deviations of the odd and even melodies are as follows:

- Mean (odds) 131.5
- Standard Deviation (odds) 37.8
- Mean (evens) 130.8
- Standard Deviation (evens) 35.7

The probable error of a test score is 4.96, indicating that the chances are one to one that a test score is in error by no more than one-thirty-sixth of the range, or twenty to one that it is in error by no more than one-twelfth of the range.

This evidence and the report of the jury of "experts" given in an earlier section seem to indicate that the test is reliable, and valid at least as to general content.
V. TREATMENT OF THE DATA

A. How Collected

In the effort to obtain objective measurements that would indicate the problems which public school music majors find difficult to solve at sight, an elaborate system of bookkeeping was set up so that total scores might be obtained with absolute accuracy, means computed easily, and the number of perfect and zero scores obtained easily. Table III shows the means and frequencies of perfect and zero scores on each melody. Read the table downward as follows. The subjects made a mean score right on melody 1 of 13.6; the mean number of pitch errors made was 1.8; of rhythm errors, .6. Sixty-one subjects made perfect scores on the melody in pitch, and eighty-one in rhythm. Thirteen failed completely on each measure in pitch, and eight failed completely in rhythm.¹

Examination of these data indicates the melodies which contained genuine difficulties for a large part of the group tested. Any melody which was sung perfectly by many people obviously is easy. On the other hand, a large number of zero scores indicates unsolved problems. Use of separate scores for pitch and rhythm aids in locating that difficulty.

¹Note that there are eight possible errors in pitch, and eight possible errors in rhythm. The possible score right is sixteen.
### TABLE III

**TABLE OF MEANS, AND FREQUENCIES OF PERFECT AND ZERO SCORES ON EACH MELODY OF THE TEST**

<table>
<thead>
<tr>
<th>Melodies</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Score Right</td>
<td>13.6</td>
<td>13.7</td>
<td>11.3</td>
<td>12.5</td>
<td>8.7</td>
<td>12.1</td>
<td>11.4</td>
<td>8.6</td>
<td>8.6</td>
<td>7.4</td>
<td>11.8</td>
<td>12.4</td>
<td>9.1</td>
<td>7.8</td>
</tr>
<tr>
<td>Mean Pitch Errors</td>
<td>1.8</td>
<td>2.0</td>
<td>3.9</td>
<td>3.0</td>
<td>3.2</td>
<td>2.2</td>
<td>3.4</td>
<td>3.6</td>
<td>4.4</td>
<td>5.1</td>
<td>3.3</td>
<td>2.8</td>
<td>5.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Mean Rhythm Errors</td>
<td>.6</td>
<td>.3</td>
<td>.8</td>
<td>.5</td>
<td>4.1</td>
<td>1.7</td>
<td>1.2</td>
<td>3.8</td>
<td>3.0</td>
<td>3.5</td>
<td>.9</td>
<td>.8</td>
<td>1.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Perfect Scores, Pitch</td>
<td>61</td>
<td>50</td>
<td>12</td>
<td>22</td>
<td>29</td>
<td>23</td>
<td>18</td>
<td>18</td>
<td>8</td>
<td>2</td>
<td>23</td>
<td>27</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Perfect Scores, Rhythm</td>
<td>81</td>
<td>88</td>
<td>77</td>
<td>89</td>
<td>38</td>
<td>29</td>
<td>70</td>
<td>43</td>
<td>14</td>
<td>33</td>
<td>77</td>
<td>72</td>
<td>49</td>
<td>29</td>
</tr>
<tr>
<td>Zero Scores, Pitch</td>
<td>13</td>
<td>4</td>
<td>12</td>
<td>2</td>
<td>15</td>
<td>7</td>
<td>13</td>
<td>19</td>
<td>13</td>
<td>23</td>
<td>12</td>
<td>8</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Zero Scores, Rhythm</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>48</td>
<td>2</td>
<td>9</td>
<td>47</td>
<td>13</td>
<td>40</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
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<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>----------------------</td>
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<td>----</td>
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<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Mean Score Right</td>
<td>8.9</td>
<td>11.0</td>
<td>8.6</td>
<td>7.6</td>
<td>10.1</td>
<td>9.4</td>
<td>8.7</td>
<td>8.6</td>
<td>7.0</td>
<td>6.3</td>
<td>8.4</td>
<td>8.2</td>
<td>5.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Mean Pitch Errors</td>
<td>5.3</td>
<td>3.1</td>
<td>4.8</td>
<td>5.7</td>
<td>3.6</td>
<td>3.4</td>
<td>4.7</td>
<td>4.5</td>
<td>5.2</td>
<td>4.7</td>
<td>5.1</td>
<td>5.7</td>
<td>6.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Mean Rhythm Errors</td>
<td>1.8</td>
<td>1.9</td>
<td>2.6</td>
<td>2.7</td>
<td>2.3</td>
<td>3.2</td>
<td>2.6</td>
<td>2.9</td>
<td>3.8</td>
<td>5.0</td>
<td>2.5</td>
<td>2.1</td>
<td>4.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Perfect Scores, Pitch</td>
<td>2</td>
<td>24</td>
<td>11</td>
<td>4</td>
<td>16</td>
<td>21</td>
<td>14</td>
<td>11</td>
<td>10</td>
<td>15</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Perfect Scores, Rhythm</td>
<td>51</td>
<td>58</td>
<td>44</td>
<td>46</td>
<td>54</td>
<td>27</td>
<td>48</td>
<td>21</td>
<td>28</td>
<td>6</td>
<td>13</td>
<td>35</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Zero Scores, Pitch</td>
<td>18</td>
<td>10</td>
<td>21</td>
<td>42</td>
<td>13</td>
<td>6</td>
<td>24</td>
<td>19</td>
<td>25</td>
<td>31</td>
<td>12</td>
<td>6</td>
<td>47</td>
<td>43</td>
</tr>
<tr>
<td>Zero Scores, Rhythm</td>
<td>6</td>
<td>16</td>
<td>23</td>
<td>21</td>
<td>25</td>
<td>17</td>
<td>22</td>
<td>14</td>
<td>33</td>
<td>24</td>
<td>9</td>
<td>1</td>
<td>20</td>
<td>85</td>
</tr>
</tbody>
</table>
Although this device will not locate all the problems encountered by the students, it will indicate some. The ones that are disclosed are shown objectively to have a certain difficulty; there can be no doubt as to their presence; and they will be problems which reflect the larger aspects of musicianship. Other methods of locating difficulties will have the disadvantage for the present purpose of stressing problems which will require a greater degree of subjective interpretation. For these reasons, it was decided to limit analysis of melodies to those which clearly demonstrated the presence of difficulties of huge proportions. Those melodies are the ones on which few people made perfect scores on either rhythm or pitch, or on which many failed entirely. Of the melodies selected for analytical attention 3, 13, 14, 15, 19, 21, 24, and 27 will receive attention in a later section dealing with the experimental melodies. Melodies 4, 8, 9, 17, 18, 23, 25, 26, and 28 are dealt with here.

B. Analysis of Success and Failure on the Melodies

MELODY 5

48 zero scores on rhythm. 15 zero scores on pitch.
38 perfect scores on rhythm. 29 perfect scores on pitch.
Mean score right 8.7  Mean errors rhythm 4.1  pitch 3.2

The many failures on rhythm were due to the lack of recognition by many students of alla breve measure. The rather high number of perfect scores on rhythm indicates
that music majors split rather sharply between mastery and non-mastery of this very common problem of music notation. Fourths, such as "mi-la", "do-fa", and "ti-si" created difficulty for many.

MELODY 8

47 zero scores on rhythm. 19 zero scores on pitch.
43 perfect scores on rhythm. 18 perfect scores on pitch.
Mean score right 8.6  Mean errors rhythm 3.8  pitch 3.6

The many failures on rhythm were due to the failure of many to recognize the two-beat to the measure character of the melody despite the presence of all commonly used indications. Again the students split sharply, roughly fifty-fifty, between those who recognize and those who do not.

MELODY 9

8 perfect scores on pitch. 14 perfect scores on rhythm.
13 zero scores on pitch. 13 zero scores on rhythm.
Mean score right 8.6  Mean errors pitch 4.4  rhythm 3.0

The presence of a modulation to the relative minor following an altered dominant descending arpeggio accounts for the fewness of the perfect scores in pitch. This melody is in G flat major. The small number of zero scores indicates clearly that these students generally are able to orient themselves in the less frequently used keys. This was corroborated by other melodies in the test. The infrequency of perfect scores on rhythm may be due to either or both of two reasons, failure to have complete
orientation to the two-beat character of the six-eight measure, or inability to surmount the difficulty found in the arpeggio mentioned above.

**MELODY 17**

11 perfect scores on pitch. 44 perfect scores on rhythm.
21 zero scores on pitch. 23 zero scores on rhythm.
Mean score right 8.6  Mean errors pitch 4.8  rhythm 2.6

The small number of perfect scores in pitch is due to the presence of modulations to the relative minor and the super-tonic, and the tone problems, "do-si-la", "fa-di-re", and "mi-la".

**MELODY 18**

42 zero scores on pitch. 21 zero scores on rhythm.
4 perfect scores on pitch. 46 perfect scores on rhythm.
Mean score right 7.6  Mean errors pitch 5.7  rhythm 2.7

An interesting situation is disclosed by the presence of many zero scores in pitch accompanied by many perfect scores in rhythm. That this is not an accidental situation was demonstrated to the examiner. Genuine difficulties in pitch were met in this melody in the steadily descending modulations. Despite the huge obstructions interposed, these students responded with a great deal of rhythmic assurance. The three tone anacrusis in two-four measure is not difficult for them. Melody 21 containing a seven tone anacrusis in three-four measure discloses a quite similar degree of assurance on their part. It seems clear that such rhythms are thoroughly mastered and can be used comfortably despite very difficult pitch problems. The
small number of perfect scores in pitch again indicates inability to cope with modulations.

MELODY 23
10 perfect scores on pitch. 25 perfect scores on rhythm.
23 zero scores on pitch. 33 zero scores on rhythm.
Mean score right 7.0 Mean errors pitch 5.2 rhythm 3.8

Inability to cope with the minor mode at a rapid speed, and with the tonal problems, "fa-sol-re", "mi-fa-fi-sol-do", and "do-ti-te-la-si", account for the small number of perfect scores and the rather large number of pitch failures. A faltering type of response was the typical one obtained. Few students are able to respond to the minor mode in eighths and sixteenths at 72 quarter note beats per minute.

MELODY 25
8 perfect scores in pitch. 13 perfect scores on rhythm.
12 zero scores on pitch. 9 zero scores in rhythm.
Mean score right 8.4 Mean errors pitch 5.1 Rhythm 2.5

The low number of perfect scores in pitch, the only significant indication here, is due to the presence of a modulation to the relative minor of the dominant followed by the dominant. Such modulations seem to be "beyond" these students. The rhythm of the fifth measure (see the melody in the appendix) caught most of the students, reducing the number of perfect scores in rhythm to a low figure.
MELODY 26

4 perfect scores in pitch. 35 perfect scores in rhythm.
6 zero scores in pitch. 1 zero score in rhythm.
Mean score right 8.2 Mean errors pitch 5.7 Rhythm 2.1

An enharmonic change of "do" to "mi" was an insuperable difficulty for all but four students. An easy beginning measure accounts for the infrequency of complete failures in rhythm and pitch.

MELODY 28

43 zero scores in pitch. 85 zero scores in rhythm.
9 perfect scores in pitch. 3 perfect scores in rhythm.
Mean score right 4.0 Mean errors pitch 5.2 Rhythm 6.8

As far as pitch is concerned, this is a simple melody in E flat major, with a simple modulation to the dominant and some very common chromatics. Rhythmically, it is more difficult, being in twelve-eight measure and consisting of quarter notes, sung three against two beats. As 85 failed completely with the rhythm and only three succeeded, it is quite evident that this is well "beyond" these students.

Few showed any recognition of the problem. The only explanation that occurs to the writer as to the great failure in pitch is that the rhythm problem was so overpowering that all poise and balance was lost.

It may be recalled that fourteen of the melodies were designed to test certain factors as related to speed of response. A description of the melodies, the grades assigned
to each form on the five factors, measure signature, key
signature, rhythm, tonality, and speed, and the position of
each form in the test, are to be found in Table IV. Read in
this manner. Experimental melody II is in the key of "a" 
minor, and is in three-four measure. The minor tonalities
are the outstanding characteristic of the melody. In an
effort to scale speed and rhythm, four forms were devised.
The following grades were assigned to form I on the judgment
of the investigator:² one on difficulty of the measure sig-
nature; one on difficulty of the key signature; one on diffi-
culty of the rhythm problems; two on difficulty of the
tonality problems; and one on difficulty of speed. This
form was assigned third place in the test on the basis of
its difficulty index, (sum of the five grades), and the re-
action of an experimental group of ten subjects.

Comparative data and analysis of the responses of the
subjects on the several forms of each experimental melody
follow on succeeding pages of this report.

The four forms of experimental melody I shown in Table V
were designed to provide speed tests roughly in the ratios
of 1:2:3:4. Sixteen students, 14% of the total number, failed
totally to maintain the required speed or faltered somewhere
in each measure of melody 16. Fifty-eight, approximately
half, were able to respond with perfect rhythm to this

²Please observe that these judgments were not entirely
haphazard. The assignment of grades was based on definite
criteria which were accepted by a jury of experts. See
sections C, D, and E of chapter III.
<table>
<thead>
<tr>
<th>Description</th>
<th>Form</th>
<th>Grades on</th>
<th>Position in Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measure</td>
<td>Key</td>
</tr>
<tr>
<td>Melody I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key of C</td>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Four-four Measure</td>
<td>II</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Easy Rhythm and Tonality</td>
<td>III</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Speed graded</td>
<td>IV</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Melody II</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Key of A</td>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Three-four Measure</td>
<td>II</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Minor Tonality</td>
<td>III</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Speed and Rhythm Graded</td>
<td>IV</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Description</td>
<td>Form</td>
<td>Measure</td>
<td>Key</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>---------</td>
<td>-----</td>
</tr>
<tr>
<td>Melody III</td>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Key of C</td>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4, 3, 2</td>
<td>II</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Measure</td>
<td>III</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Abrupt modula-</td>
<td></td>
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<tr>
<td>tion and Re-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>turn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diminished</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed Scaled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melody IV</td>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Key of A</td>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4, 2, 4, 8</td>
<td>II</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Measure</td>
<td>III</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Diminished</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Figures</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Speed Scaled</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
supposedly difficult problem. It is likely that they could have sung this melody at a still faster tempo.

It is not likely that the higher mean of pitch errors of melody 7 which is reflected in the high number of zero scores in pitch has any real significance.

**TABLE V**

**MEAN SCORES AND FREQUENCIES OF PERFECT AND ZERO SCORES ON THE FIRST GROUP OF EXPERIMENTAL MELODIES**

<table>
<thead>
<tr>
<th></th>
<th>Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Position in test</td>
<td>2</td>
</tr>
<tr>
<td>Mean score right</td>
<td>13.7</td>
</tr>
<tr>
<td>Mean pitch errors</td>
<td>2.0</td>
</tr>
<tr>
<td>Mean rhythm errors</td>
<td>.3</td>
</tr>
<tr>
<td>Perfect scores, pitch</td>
<td>50</td>
</tr>
<tr>
<td>Perfect scores, rhythm</td>
<td>88.7</td>
</tr>
<tr>
<td>Zero scores, pitch</td>
<td>4</td>
</tr>
<tr>
<td>Zero scores, rhythm</td>
<td>1</td>
</tr>
</tbody>
</table>

Evidently, these melodies fail to measure speed difficulties.

The four melodies shown in Table VI were graded as of second degree difficulty in tonality. As over half of the measures were sung incorrectly as indicated by the mean errors in pitch, it is probable that the melodies should have been graded three or difficult.

Two problems were encountered by the subjects. One was
TABLE VI

MEAN SCORES AND FREQUENCIES OF PERFECT AND ZERO SCORES ON THE SECOND GROUP OF EXPERIMENTAL MELODIES

<table>
<thead>
<tr>
<th>Forms</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position in test</td>
<td>3</td>
<td>14</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>Mean score right</td>
<td>11.3</td>
<td>7.8</td>
<td>8.7</td>
<td>6.3</td>
</tr>
<tr>
<td>Mean pitch errors</td>
<td>3.9</td>
<td>4.3</td>
<td>4.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Mean rhythm errors</td>
<td>.8</td>
<td>3.9</td>
<td>2.6</td>
<td>5.0</td>
</tr>
<tr>
<td>Perfect scores, pitch</td>
<td>12</td>
<td>21</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Perfect scores, rhythm</td>
<td>77</td>
<td>29</td>
<td>43</td>
<td>6</td>
</tr>
<tr>
<td>Zero scores, pitch</td>
<td>12</td>
<td>19</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>Zero scores, rhythm</td>
<td>2</td>
<td>30</td>
<td>22</td>
<td>24</td>
</tr>
</tbody>
</table>

the interval, "re-si", and the other was the specific type of the rhythm of the last three melodies. The failure to recognize and interpret the interval, "re-si", was disastrous to many. Many failed to recover during the rest of the melody. Some did recover but not until several measures had been sung incorrectly.3

As the rhythm of melody 14 gives many short periods of rest or repose, it was expected that it would be less difficult than melody 21, whose tempo was sharply increased, and melody 24, which has a very complex rhythm. However, more subjects failed completely in rhythm on melody 14 than

3Observe that this is a simple problem of the dominant seventh chord. Do these students only recognize it in the major mode?
on either of the other two. The thirty who failed, 27% of the total group, sang the more rapid tones as triplets, as all sixteenths, or as eighth notes only, distorting the tied tone (usually shortening it), often losing the tempo entirely and rushing in the typical flustered manner of the unskilled performer. Obviously, both pitch and rhythm were difficult for these subjects, but the response on rhythm was both unexpected and astonishing.

The success of forty-eight subjects on the rhythm of melody 21, although sung at a faster tempo than the other melodies, seems to indicate two things. First, it acts as corroboration of the fact that the rhythm of melody 14, which has a high frequency of use in music, has not been mastered by these students. Second, it indicates that the seven-tone anacrusis used in that form does not offer great difficulty. That this type of rhythm is easy for them is also demonstrated by their response to melody 18 which has been discussed earlier.

The response to melody 24 only indicates that which was expected, that mixed triplet eighth notes and syncopated eighths offer very difficult problems for such students, only six indicating mastery.

The problem set in the melodies reported in Table VII is similar to that in melodies 2, 7, 12, and 16 reported in Table V. Speeds set up are 108 tones per minute, 168 tones per minute, and 240 tones per minute. Tonality difficulty is classed as of second grade because of the presence of chromatics and an abrupt modulation.
TABLE VII
MEAN SCORES AND FREQUENCIES OF PERFECT AND ZERO SCORES ON THE THIRD GROUP OF EXPERIMENTAL MELODIES

<table>
<thead>
<tr>
<th>Forms</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position in test</td>
<td>4</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>Mean score right</td>
<td>12.5</td>
<td>11.8</td>
<td>10.1</td>
</tr>
<tr>
<td>Mean pitch errors</td>
<td>3.0</td>
<td>3.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Mean rhythm errors</td>
<td>0.5</td>
<td>0.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Perfect scores, pitch</td>
<td>22</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>Perfect scores, rhythm</td>
<td>89</td>
<td>77</td>
<td>54</td>
</tr>
<tr>
<td>Zero scores, pitch</td>
<td>2</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Zero scores, rhythm</td>
<td>2</td>
<td>7</td>
<td>25</td>
</tr>
</tbody>
</table>

Tones at the rate of 240 per minute are not particularly "beyond" the ability of such students, even when calling for the interpretation of moderately difficult tonal patterns. Twenty-five failed completely on rhythm in melody 19, but fifty-four turned in perfect scores. Perfect scores were reduced by the increase in speed, but it is clear that these students were not greatly handicapped by the rather high rate of speed. However, the abrupt increase in mean errors in rhythm and in number of zero scores in rhythm lends strength to the prediction that the limit of ability to respond at rapid rates of speed to a pitch problem of this difficulty was being approached quite closely.
TABLE VIII
MEAN SCORES AND FREQUENCIES OF PERFECT AND ZERO SCORES ON
THE FOURTH GROUP OF EXPERIMENTAL MELODIES

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position in test</td>
<td>13</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>Mean score right</td>
<td>9.1</td>
<td>8.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Mean pitch errors</td>
<td>5.3</td>
<td>5.3</td>
<td>6.4</td>
</tr>
<tr>
<td>Mean rhythm errors</td>
<td>1.6</td>
<td>1.8</td>
<td>4.5</td>
</tr>
<tr>
<td>Perfect scores, pitch</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Perfect scores, rhythm</td>
<td>49</td>
<td>51</td>
<td>35</td>
</tr>
<tr>
<td>Zero scores, pitch</td>
<td>22</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Zero scores, rhythm</td>
<td>7</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

Data on the response to the melodies of the fourth experimental group are given in Table VIII. The melody used as the basis for this group is a masterly demonstration by Beethoven of the proper use of the diminished triad. The melody moves around the leading tone, finally passing into the diminished seventh chord to precede the closing cadence. Such idioms as these are very commonly used, so often used as to gain the distaste of the cultured musician who points out the saccharine character of the idioms as used by the untrained musician. The freshmen tested will have studied the chords extensively in second or third term harmony, courses which at Indiana State are given in the freshman year. Senior college students will have had the advantage
of frequent use of the chords in instrumental study. De-
spite these facts, practically none recognized the dimin-
ished seventh idioms. Failure at recognition was almost 
complete, not even a vague awareness being indicated by the 
great majority. Then, a passage containing a minor third 
built on the leading tone, followed by a diminished third 
on the same tone, was sung accurately by no more than six 
subjects on any one of the forms.

The failure in pitch nullified the effort to gain a 
measure of the relation of speed to extreme tonal diffi-
culties. However, something else showed up. The scheme for 
gaining speed in this group of melodies was that of changing 
the size of the measure or the size of the beat tone.

Note values are entirely relative. There is no fixed 
value for any particular type of note. Its value depends 
on the beat note indicated in the measure signature. In 
the group of melodies under consideration, differentiation 
was made between the first two by using a note for the 
second melody just half as large as that used in the first 
and retaining the same beat note, a quarter note, for both.

In the third melody, however, a sharp change was made. 
Here, both the beat note and the typical note of the melody 
were changed. The measure signature was changed to four-
eight and sixteenth notes were used. The net result is that 
melody 27 is much the same as melody 15. However, some tones 
were added changing some chord-wise steps to scale-wise steps, 
(the latter are considered easier), and the speed was stepped
up from 112 tones per minute to 168 per minute.

Thirty-five displayed recognition and mastery of the rhythm problem of melody 27. Almost all of the remainder were unable to orient themselves to the eighth note as the beat note. This is clearly indicated by the fact that the mean rhythm errors were 4.5 in spite of the complete success of thirty-five subjects. What seems to be a paradox is to be observed in the fact that only one subject failed on all the measures in rhythm. The explanation is that the first measure is a simple scale-wise problem easily responded to. This only demonstrates the greater indicativeness of the mean of 4.5. This mean was created by 77 subjects on seven measures and one subject on eight measures. The typical response following the first measure was a hurried one, indicating clearly an irresistible desire to pass over into two-four measure, in spite of the fact that speed was already fairly great. The marked inability of two-thirds of the subjects to respond to four-eight measure in another important disclosure of this group of melodies.

Forms I and II were written in four-four and two-four measure. Mean errors in rhythm of 1.6 and 1.8 respectively were made. This seems to be definite corroboration of the fact already disclosed that these more commonly found types of measure signatures and rhythm problems are highly over-learned and are responded to with a high degree of accuracy in spite of attendant pitch difficulties of high order.
VI. OTHER PHASES OF THE INVESTIGATION

In addition to suggesting the devising of a means of measurement of sight reading skills and of locating typical musical idioms on which special music students succeed and fail, the closing paragraphs of chapter one of this report directed attention to a number of attendant problems which may have some general interest.

A. Band and Orchestra Instrumental Majors Versus Piano and Organ Majors

To what extent does the study of different instruments or means of expression, such as the violin, piano, or voice, and the courses of study for these, affect the attainments in sight reading?

Each subject filled out a small form listing his instruments and indicating the amount of training as little, considerable, or much. The typical report showed one instrument as much, one or more, often several, as little, and sometimes one as considerable. In addition to reporting on instruments, each one indicated the amount of vocal training as none, little, considerable, or much.

It seems safe to presume that the report, much, after the name of an instrument indicates the major instrument of that student. Even if he should for some unusual reason be majoring on some other instrument, it is likely that any accrual of sight reading skill because of instrumental study will have resulted chiefly from study of the instrument.
so indicated. The instruments so indicated and the frequencies are given in Table IX.

TABLE IX
MAJOR INSTRUMENTS AND THEIR FREQUENCIES

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trumpet, baritone, or sousaphone</td>
<td>10</td>
</tr>
<tr>
<td>Clarinet</td>
<td>4</td>
</tr>
<tr>
<td>Violin</td>
<td>24</td>
</tr>
<tr>
<td>'Cello</td>
<td>2</td>
</tr>
<tr>
<td>Piano or organ</td>
<td>64</td>
</tr>
<tr>
<td>Voice</td>
<td>8</td>
</tr>
<tr>
<td>No major listed</td>
<td>1</td>
</tr>
</tbody>
</table>

Total 113

As there were too few cases to compare specific instruments, it was decided to test the possibility that piano students might reflect the type of training that is essentially solo-preparatory in character, and the woods, brasses, and strings the type that prepares chiefly for group activity. This distinction may not be clear to the non-musician. Although most of the second group may be used as solo instruments, it is certain that their greatest use by the students tested is in group activity, band, orchestra, or smaller ensemble. The violin and 'cellos are possible exceptions, but it is common observation that most of the students who play these instruments do not have solo skills sufficiently
great to cause them to devote the larger part of their attention to that type of performance. As to the piano, it is, of course, used often in group activity or in accompanying (essentially the same type of playing). However, there can be no doubt that the greater use made of the piano is in solo performance. The organ is seldom used in group activity.

In solo preparation, the performer solves his musical and technical problems, often alone, and always at his leisure. In group preparation, the demands of the group and time limitations require that musical and technical problems be solved as quickly as possible. It seems clear, then, that much experience and training on the band or orchestra instruments should develop a greater degree of sight reading skill than similar experience and training on piano or organ. There is much overlapping, to be sure, and any index obtained will probably reflect it. To separate the two is impossible on the basis of the data available from this investigation. These conditions must be kept in mind in the following report.

The scores of the band and orchestra instrument group and the scores of the piano and organ group were thrown into frequency distributions, and the data in Table X obtained.

The P. E. of the difference is 8.9. The actual difference between the means is 26.2. So the critical ratio is 2.94. This indicates that there are 97 chances
in 100 that there is a true difference between the means greater than zero: however, statistical reliability is lacking. Too few cases may have reduced the P. E. of the difference. On the other hand, this may be statistical evidence of the overlapping mentioned.

The mean score of the vocalists, not included in the data treated in Table X, is 224.4, the lowest separate mean computed. However, there were only 8 cases.

B. Junior College Students versus Senior College Students

How much does senior college instrumental study improve the sight reading ability over that obtained in the junior college ear training and sight singing?

Only by testing a specific group at least twice in its years in college, once in the sophomore year and once in the senior year, might this question be answered conclusively. However, it is believed that any other evidence obtained might be of interest.
The scores of the subjects were divided into two groups reflecting their standing in the colleges. Graduate students were included in the senior college group. Most of them were very recent graduates doing post-graduate work or were June 1934 graduates asked by heads of departments to take the test. Table XI shows the essential data.

The P. E. of the difference between the means is 8.7; the actual difference is 8.5. Therefore, the critical ratio is .98 in favor of the junior college group. The difference is of little statistical reliability, although there are 74 chances in 100 of a true difference between the means greater than zero and favoring these junior college students.

**TABLE XI**

<table>
<thead>
<tr>
<th></th>
<th>Junior College Group</th>
<th>Senior College Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>40</td>
<td>73</td>
</tr>
<tr>
<td>Means</td>
<td>268.9</td>
<td>260.4</td>
</tr>
<tr>
<td>P. E. of the means</td>
<td>6.6</td>
<td>5.7</td>
</tr>
</tbody>
</table>

This result was unexpected, and against common sense. The senior college group should be superior to the junior college group. The senior college group contains the three subjects who made scores of more than 400 on the test. This is reflected in the standard deviation of the senior
college group, which is 72.0, as compared to 65.5 for the junior college group. However, these deviations also indicate the fact that the junior college group tends to group closer and at a higher point in the distribution. To labor the point is useless, since statistical reliability is lacking, but an interesting problem is disclosed which should receive further attention.

C. Correlations With Other Factors

Certain other correlations were proposed as of possible importance.

Intelligence, as measured by the American Council Psychological Examination, and musicianship, as reflected by scores on the sight reading test, do not seem to be significantly related. The coefficient of correlation between the two is .235, based on 65 cases.

Even fewer scores were available for musical talent. Fifty-four cases were available. The coefficient of correlation between sight reading scores and combined standard scores on the Seashore Test of Musical Talent is .498. Comparison with other correlations is of interest. Tilson\(^1\) found a correlation between sight singing grades and combined standard scores on the Seashore test of .399, using 126 cases. Highsmith\(^2\), using 59 cases, obtained


of .312 between applied music marks and actual scores on separate parts of the Seashore test. Salisbury and Smith found that tonal dictation correlated comparatively high with actual scores on separate parts of the Seashore test. They obtained coefficients of .60 with one group of 132 subjects, and .79 with another group of 144. The 54 cases used in the writer's figure are too few to permit of drawing any other conclusion except that musical talent of the sort measured by the Seashore test seems to have some importance in the attainments of these subjects.

D. Syllables: Their Use By the Subject

An interesting situation was disclosed very early in the testing period. Practically all of the subjects who used syllables found themselves handicapped. The reaction of the small experimental group demonstrated their obstruc­tive value and led to a change in the directions to the extent that subjects were urged to use whatever device was convenient and to change whenever they wished.

The typical subject began the test with syllables and changed to a neutral sound in the first quarter or third of the test. Only two subjects demonstrated ability to use syllables sufficiently well to use them throughout the whole of the difficult test. These two made scores of 359 and 377, both superior scores. However, there were 15 scores of 350

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or higher, and 5 higher than 377. The other 13 superior subjects used neutral syllables exclusively. Both of the subjects who used syllables throughout the test were handicapped when response to chromatics at high speeds was required.
VII. CONCLUSIONS

The specific conclusions based on the evidence obtained in the analysis of the responses to selected melodies are considered separately from the point of view of tonality and rhythm.

A. Tonality

1. Easy tonality problems are readily solved at sight by typical public school special students, even when tones are to be responded to at the rate of 252 per minute.

2. The interval, "re-si", is of great difficulty despite its dominant character.

3. Special music students do not recognize the diminished chord, and cannot sing it.

4. Secondary chords and modulations to those chords as indicated by such tone patterns as "do-si-la", "fa-di-re", and "re-la-sol", are difficult for those students.

5. Enharmonic changes, such as E flat to D sharp, are not solved by these students.

6. The general problem of the minor mode is poorly mastered.

B. Rhythm

1. Many common rhythmic idioms are so well mastered by these students that they are able to respond accurately to the rhythm even when applied to passages containing tonal problems far beyond their ability to read at sight.
2. Some very common rhythmic patterns, notably figures of mixed eighth and sixteenth notes, are of marked difficulty for them.

3. These students lack control of four-eighth measure and seem to be unable to adjust themselves to the relatively unusual beat note.

4. The two-beat-to-the-measure character of alla breve and compound duple measure is not recognized by half of these students.

5. These students do not have control of twelve-eighth measure.

6. Cross accent, such as three tones against two beats, is not recognized by seventy-five percent of these students.

In general, it may be said that the training of these students seems to be of such character as to produce great over-learning of simple tonality and rhythm problems, such as primary chords of major keys and two-four and four-four measure. Unusual measure signatures, some common rhythmic patterns, unusual rhythmic patterns, minor tonalities, and modulations are not mastered.

The evidence indicates quite clearly that these students are adequately prepared to meet the relatively small demands on musicianship of grade school music teaching and elementary instrumental training.

Few of these students seem to meet the high standards of musicianship set by such organizations as the Music Education National Conference and the National School Band and Orchestra Associations.
There is some evidence that intelligence, as measured by the American Council Psychological Examination, is of little import in the attainment of sight reading skill. Musical talent, as measured by the Seashore Test of Musical Talent, seems to have greater significance.

The evidence suggests the possibility that the musical attainments known as musicianship are not increased during the senior college years. The writer wishes to stress the need for further investigation of this point.

Attendant problems worthy of investigation are as follows.

1. Do special music teachers gain or lose in ability to read at sight after leaving college?

2. What methods do band and orchestra directors use to develop sight reading skill in the members of their organizations?

3. Is it true that training in, and the use of, band and orchestral instruments is superior to that of piano for training in musicianship as reflected by sight reading skill?

4. Does sight reading skill come best as a by-product of the development of musicianship, or is specific drill more efficient?

Many others might be listed, but one seems to demand attention. It is entirely possible that the high standards of musicianship set by the Music Educators National Conference and the National School Band and Orchestra Associations are not reflected in the attainments of many of those students who are preparing for the direction of the groups which may participate in those contests in future years. So, the question arises:
do special music students need a higher degree of musicianship than that demonstrated by typical Indiana students on this test?
VIII. APPENDIX

A. Bibliography


"Bibliography of Tests."


SIGHT READING TEST FOR COLLEGE MAJORS

2. \( J = 92 \)

3. \( J = 63 \)

4. \( J = 108 \)

5. \( J = 88 \)

6. \( J = 92 \)

7. \( J = 72 \)

8. \( J = 92 \)

9. \( J = 56 \)