A STUDY OF THE RELATIONSHIP OF SCORES OBTAINED ON THE SEASHORE MEASURES OF MUSICAL TALENTS, THE PERSONALITY SCALE OF MANIFEST ANXIETY, AND SELECTED INTELLIGENCE TESTS, TO PHONETIC TRANSCRIPTION ABILITY

Thesis for the Degree of M. A.
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Janet Wirth Pickler

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By

Janet Wirth Pickler

AN ABSTRACT

Submitted to the College of Communication Arts
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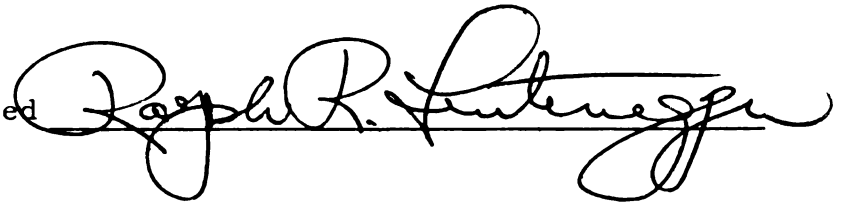
Approved 

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ABSTRACT

This study attempted to ascertain whether selected standardized tests could serve usefully in predicting success in phonetic transcription. The tests used were the Seashore Measures of Musical Talents, the Taylor Personality Scale of Manifest Anxiety, and the Michigan State University Orientation tests. The Seashore Measures were administered at the beginning and at the end of (a) a course in Applied Phonetics, and (b) a course in Voice and Diction. The students in these groups totalled 48 and 39 respectively. Tests were made to ascertain the stability of the Seashore Measures.

In addition to finding the Seashore sub-tests to be significantly intercorrelated, significant changes were found in the pre-post (before and after the academic courses) change-scores for the Seashore sub-tests of Tonal Memory and Timbre.

All of the Seashore Measures and the Orientation Test scores (other than the "numerical" sub-tests) proved to be significantly correlated with transcription scores. The most useful and economical pairing of sub-tests yielding the best prediction was that of the Seashore sub-tests Time and Tonal Memory. A prediction equation utilizing these tests was evolved. Tentative explanations were advanced to explain certain of the results, and implications of the study were suggested.

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CHAPTER I

INTRODUCTION

At the time the data for this study were collected, all students entering the speech curriculum at Michigan State University were required to study "Applied Phonetics" (Speech 375). The primary aim of this course was to train the students' ability to perceive and transcribe, the sounds utilized in the American English language. Because of the seemingly great disparity in transcription abilities of students, the question arose as to the possibility of advancing the more capable students to classes providing a more rigorous and extensive treatment of the subject matter. If such acceleration is to take place, criteria must be developed for use in predicting achievement in phonetic transcription.

Statement of the Problem

The purpose of this study is to investigate the relationship between certain psychological and psycho-acoustic factors or abilities, as measured by standardized tests, and achievement in phonetic transcription.

Specifically, this study concerns itself with:

1. the feasibility of predicting success in phonetic transcription,
2. the relationship between scores achieved on the six Seashore Measures of Musical Talents and the final grade obtained in Applied Phonetics, using the average of transcription test results as the criterion of achievement,

3. the relationship of anxiety, as measured by scores obtained through the use of the Personality Scale of Manifest Anxiety, and achievement in Applied Phonetics, as measured by the above-stated criterion,

4. the relationship of intelligence, as measured by scores obtained on the Michigan State University Orientation Tests (hereafter referred to as Achievement Battery Scores), to achievement in Applied Phonetics, measured as in 2 above,

5. the stability of Seashore scores when compared before and after taking a course in Applied Phonetics, and

6. the stability of Seashore scores when compared before and after taking a course in Voice and Diction.

Definition of Terms

Success, or achievement (in phonetic transcription), refers to an individual's ability in Applied Phonetics as measured by the average of the grades obtained on six twenty-word transcription tests dictated periodically throughout the school term.

Applied Phonetics refers to the speech course (Speech 375) offered at Michigan State University in which speech sounds are studied, with emphasis on the transcription of sounds utilized in the American English language.[1]

The Seashore Measures of Musical Talents is a disc-recorded test consisting of six sub-tests: pitch, loudness, rhythm, time, timbre and tonal memory. Auditory stimuli are presented in pairs which

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[1] The Applied Phonetics course at Michigan State University also deals with the formation of speech sounds and principles governing verbal language usage. The mastery of this material, however, is not directly measured or dealt with in this study.

require the subject to respond by making an either-or decision such as higher-lower, stronger-weaker, same-different, etc. The Seashore is fully explained in Chapter III, Section 2.

Anxiety is defined in terms of scores obtained by use of Taylor's Personality Scale of Manifest Anxiety. This Scale consists of fifty statements requiring a true or false answer. It is explained in greater detail in Chapter III, Section 2.

Intelligence refers to general college ability as measured by the eight derived scores obtained from the Michigan State University Orientation Tests. This battery of tests is more fully explained in Chapter III, Section two.

Limitations Imposed

The subjects participating in this study included students enrolled in eight of the nine sections of Applied Phonetics taught during the academic year 1956-57. The Winter 1957 Section One was excluded from this study because it was taught by a different instructor utilizing different testing techniques.

Students of Sections One and Three of Speech 208 (Voice and Diction) Spring term 1957, also participated in this study. One Voice and Diction instructor taught both of these sections.

The subjects participating in the study represent a one-year's cross-section of majors from all areas of speech specialization (in the Phonetics class), plus (in the Voice and Diction classes) a representative majority of non-speech majors.

Justification of the Project

This study attempts to relate the Seashore Measures of Musical Talents, the Personality Scale of Manifest Anxiety, and the Michigan State University Orientation Tests to success in Applied Phonetics.

Each of the six sub-tests of the Seashore--Pitch, Loudness, Rhythm, Time, Timbre and Tonal Memory--measures an ability or factor inherent in both music and speech. The relationship between these factors and phonetic transcription ability has not been studied previously.

The importance of this study lies in determining whether or not any of the abilities or factors measurable through the Seashore Measures of Musical Talents can be used to predict ability in phonetic transcription. An additional value is the determination of the relationship of intelligence and anxiety to success in phonetic transcription. This study seeks to provide a possible measure for selecting students to be placed in an accelerated course in Applied Phonetics. An enriched course would be more rewarding to them, and consequently to the Speech Department.

This study is also important for testing the stability of the Seashore tests. According to Seashore the scores should remain unchanged, because they measure innate abilities.

Materials and Sources

The materials used in this study are the Seashore Measures of Musical Talents and the Personality Scale of Manifest Anxiety. They are explained in detail in Chapter III, Section 2.

Sources used for reference, and enumerated in the Bibliography, include unpublished dissertations, journal articles, pamphlets, manuals, and speech, music and psychology books.

Plan of Organization

This study is presented in five chapters. Chapter I consists of the Introduction plus six sections, namely: (a) Statement of the Problem, (b) Definition of Terms, (c) Limitations Imposed, (d) Justification of the Project, (e) Materials and Sources, and (f) Plan of Organization.

Chapter II consists of a review of pertinent literature.

Chapter III contains four sections which explain: (a) Subjects, (b) Materials and Equipment, (c) Procedure, and (d) Statistical Treatment.

Chapter IV consists of an analysis and discussion of results.

Chapter V contains the conclusions and implications.

The remaining section contains the bibliography.

CHAPTER II

SUMMARY OF PERTINENT LITERATURE

Since the publication of the Seashore Measures of Musical Talents four decades ago, a considerable amount of material has been written dealing with the description, theory, application, reliability, and validity of the Measures. The majority of these studies were written prior to the 1939 Revision. It would be a huge task to review all the literature dealing with the Seashore Measures. It is more important to review the research most closely related to the present study.

Studies of Prediction

Several studies have been designed which concern the use of the Seashore Measures of Musical Talents for purposes of prediction. Wilson[1] administered the Seashore to 53 students enrolled either in Music Education or as music majors in Liberal Arts. His criteria for achievement were grades in sight-reading, dictation, and harmony. "The study was designed to establish the relative importance of musical and intellectual factors as they affect the academic achievement of music students."[2] The results indicated that the Seashore Measures of Timbre

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[1]William E. Wilson, "Use of the Seashore Measures of Musical Talents in the Prediction of Certain Academic Grades for Music Students at the Pennsylvania State College" (unpublished Master's thesis, Department of Psychology, Pennsylvania State College, 1950).

[2]Ibid., p. 40.

and Tonal Memory were the most useful variables in the prediction of melodic dictation grades. Loudness and Tonal Memory were the most useful in the prediction of sight-reading grades. Regarding his study Wilson states:

> Certain implications about the value of the Seashore in prediction can be made. In terms of its use in vocational guidance or in the selection of music students who are planning to enter Music Education, a saving in time is indicated. Only three of the sub-tests--Loudness, Timbre, and Tonal Memory appear to have predictive value (if one restricts their use to that requirement) for the criteria used. [3]

Christy[4] recently studied the relationship between musicality, intelligence, and achievement of undergraduate music students. His music aptitude battery consisted of the Revised Seashore plus the Drake Musical Memory and Madison Tonal Imagery tests. He concluded that:

> . . . in general, the correlations found between the various music criteria, music aptitude tests, and intelligence are positive and low, indicating relationships of some significance between these factors but not high enough values for individual predictive purposes. [5]

An evaluation of the Seashore and the Kwalwasser-Dykema music tests (at the college level) was carried out by Holt. She concluded that ". . . prediction for individuals is probably unsafe except in the tests of Tonal Memory, Pitch, Loudness, and possibly Timbre."[6]

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[3] Ibid., p. 45.

[4] Leo John Christy, "A Study of the Relationship between Musicality, Intelligence, and Achievement" (unpublished Doctoral dissertation, School of Music, Indiana University, 1956).

[5] Ibid., p. 26.

[6] Vee Jane Holt, "An Evaluation of the Seashore and the Kwalwasser-Dykema Music Tests at the College Level" (unpublished Master's thesis, Department of Psychometrics, University of Minnesota, 1941), p. 50.

Farnsworth[7] designed a study to determine whether or not music capacity tests were more important than intelligence tests in predicting grades for certain music subjects. He administered the Seashore tests of Pitch and Tonal Memory, and the Thurstone and Iowa High School Content tests to music and non-music majors. One group had taken a course emphasizing "tonal elements"; the other had taken a course emphasizing "academic aspects." He concluded that music capacity and intelligence scores have variable potencies in the prediction of music grades. Using the multiple correlation technique, he obtained a correlation coefficient of .17 between Pitch and Tonal Memory, and the History-Music Appreciation course; and a correlation coefficient of .28 between Pitch and Tonal Memory, and the Theory course. Regarding these results, Farnsworth states:

> It is evident that in courses in which tonal perception and performance are emphasized, the music capacity tools will prove to be better tools of prediction than in those situations in which the academic side is stressed. For the intelligence tests the reverse will be true.[8]

Highsmith[9] designed a study to determine the extent to which the Seashore Measures of Musical Talents enable us to predict success of entrants in a school of music. His subjects were 49 girls.

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[7]Paul Farnsworth, "Are Music Capacity Tests More Important than Intelligence Tests in the Prediction of the Several Types of Music Grades?," The Journal of Applied Psychology, XIX (1935), 347-350.

[8]Ibid., p. 350.

[9]J. A. Highsmith, "Selecting Musical Talent," The Journal of Applied Psychology, XIII (1929), 486-493.

He obtained scores from five Seashore Measures (Pitch, Time, Consonance, Tonal Memory, and Intensity), the Terman Group Test of Mental Ability, Thurstone Psychological Examination, plus all grades from their college courses. He concluded that ". . . the Seashore tests proved of doubtful value as a means of predicting the probable success of students in music."[10]

Studies of Intelligence

Seashore believed that "rating on intelligence as a supplement of musical talent is one of the best indices for the prediction of success in music education or a musical career."[11] However, studies show differing opinions regarding the value of intelligence scores (as opposed to the Seashore) for predictive purposes.

Wilson, using the Moore-Castore test, found that it was of no use for predicting the academic grades of music students. He concluded:

> It follows that the knowledge of the students' intelligence scores is of no consequence in the prediction of their success in certain academic courses, if the population used constituted an adequate sample of music students in general.[12]

Bienstock[13] in her review of studies of musical aptitude, cites a study by Chadwick concerning sight-singing and ear-training:

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[10] Ibid., p. 497.

[11] Carl Seashore, "Musical Intelligence," Music Educator's Journal, XXIV (1938), 32.

[12] Wilson, p. 49.

[13] Sylvia Bienstock, "A Review of Recent Studies of Musical Talent," Journal of Educational Psychology, XXXIII (1942), 427-441.

> The general trend of these results suggested that for achieving success in ear-training or sight-singing, a high score on the talent test, particularly on the Pitch or Tonal Memory tests, was more important than a high intelligence quotient.[14]

Christy's results indicated a positive relationship between intelligence and music scores. He states:

> The variable of ACE intelligence scores shows a predominantly positive relationship with the scores made on the Music Aptitude Battery--the correlations ranging from -. 16 to +. 34, with seven of the eighteen significant.[15]

He concluded that ". . . there is only a small degree of relationship between musicality, as measured by the present aptitude battery and intelligence as measured by the ACE test."[16]

Fracker and Howard[17] designed a study to correlate intelligence and musical talent among university students. They used two Seashore Measures--Pitch and Intensity--, the Otis SA (Higher Form), and the Army Alpha. The results of the correlations showed a .01 for Intensity and the derived intelligence scores, and .32 for Pitch and intelligence scores.

Farnsworth obtained a correlation of .42 between two intelligence tests and the History-Music Appreciation course, and .27 between intelligence and theory course grades. He states:

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[14] Ibid., p. 433.

[15] Christy, p. 84.

[16] Ibid., p. 84.

[17] George Fracker and Virgie Howard, "Correlation between Intelligence and Musical Talent among University Students," Psychological Monographs, XXXIX (1928), 157-161.

> The two intelligence tests were found to be significantly superior to the two music capacity tests in the prediction of the "more academic" grades from courses in the history and appreciation of music. Neither type of test appeared to be significantly superior in the prediction of the "more tonal" grades from courses in music theory.[18]

Highsmith believes that intelligence tests yield a better prediction of probable success in Music School than does the Seashore. He obtained the following coefficients of correlation:[19]

	Intelligence	Academic	Music theory	Applied music
Averaged Seashore tests	.362	.526	.426	.130
Intelligence		.714	.660	.334
Academic courses			.610	.260
Music theory				.110

Highsmith states:

> The question may be raised here as to whether the Seashore tests, though giving low correlations with marks, do not nevertheless measure distinct factors in musical capacity. As a tentative answer to this question the partial and multiple correlations for applied music marks, Seashore tests, and intelligence were calculated.
>
> The partial correlation of Applied Music marks and Seashore test scores when intelligence is held constant is .173. The multiple correlation for Applied Music with the Seashore tests and intelligence together is .453. Since the correlation between Applied Music marks and intelligence is .423, it appears that the Seashore tests add but little that is not included in the intelligence tests.[20]

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[18] Farnsworth, p. 350.

[19] Highsmith, p. 489.

[20] Highsmith, p. 490.

Stanton[21] carried out an extensive study covering a ten-year period, using the Seashore Measures and the Iowa Comprehension Test (a group test of general intelligence). These tests were administered to all students entering the Eastman School of Music. On the basis of this battery, individuals were segregated into five classes: discouraged, doubtful, possible, probable, and safe. Regarding this study Mursell states:

> Annual academic survival, avoidance of dismissal, attainment of scholarships and honors, recital appearances, and graduation were the most important factors considered. In all these respects an increasing degree of success was demonstrated in passing from the low to the high groupings. The most typical and directly convincing results were those for graduation. Of the discouraged group 17 percent graduated; of the doubtful group 23 percent; of the possible group 33 percent; of the probable group 42 percent; of the safe group 60 percent.[22]

Stanton's assumption was that the intelligence test was a part of the battery. The influence of intelligence wasn't separated from the Seashore, so the predictive efficiency of the Seashore as a whole is unknown.

A study of the relationship between certain mental and personality traits and ratings of musical abilities was explored by Cooley. He administered the Seashore, ACE, Cooperative Reading Comprehension Test, and the Personality Inventory of Robert C. Bernreuter to a group of music students. His results show that " . . . general

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[21]Hazel Stanton, Measurement of Musical Talent: The Eastman Experiment (Iowa City: University of Iowa Press, 1935).

[22]James Mursell, The Psychology of Music (New York: W. W. Norton & Company, Inc., 1937), p. 297.

intelligence is a concomitant of musical talent, and that other more specific abilities tend to go with musical talent."[23]

Stability of the Seashore

Seashore believed that all of the Measures should remain constant, with the exception of Tonal Memory. He stated:

> Every normal person is born with a brain capacity for memory far beyond what is ever developed. Indeed, it is safe to say that any normal child, or adult beyond middle age, may increase his memory by proper training at least tenfold, and often much more, and still not utilize his capacity to the limit. Such improvement in the use of a given brain capacity is no evidence of improving the capacity; it is nothing but evidence of acquired ability to use the available instrument or capacity.[24]

A study by McCarthy[25] supports the view of Seashore. A group of 93 university students enrolled in a basic psychology course were given the Seashore tests of Pitch, Intensity, and Tonal Memory four times. The first day each test was given twice, in the following order: Pitch, Intensity, Memory, Memory, Intensity, Pitch. Two days later the tests were administered again in the following order: Memory Intensity, Pitch, Pitch, Intensity, Memory.

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[23]John Christopher Cooley, "A Study of the Relation between Certain Mental and Personality Traits and Ratings of Musical Abilities" (unpublished Doctoral dissertation, School of Education, Michigan State College, 1952), p. 157.

[24]Carl Seashore, The Psychology of Musical Talent (Boston: Silver, Burdett and Company, 1919), p. 236.

[25]Dorothea McCarthy, "A Study of the Seashore Measures of Musical Talent," Journal of Applied Psychology, XIV (1930), 437-55.

The results show that Pitch scores remain unchanged. Intensity increased from 66 to 82 in percentile rank from first to fourth administrations.

> This striking effect of practice in the intensity test is only apparent, however, for it is really a function of the measures used. Many people make very high raw scores on the intensity test and hence the norms expressed in percentiles decrease very rapidly so that a difference of one or two points in raw score makes a very large difference in percentile rank. When the per cent correct is used as the measure and the medians and quartiles are found, the marked practice effect noted according to the first method disappears and there is a difference of only two per cent in the medians.[26]

There was an improvement shown in Tonal Memory scores. The median percentile rank increased from 55 to 75. There was a corresponding increase in median percent of 76 to 84. McCarthy states:

> The one test which is outstanding in both reliability and in validity is the test of tonal memory. This test would probably prove the most useful single test in practical usage, not only because of high reliability and fairly high validity, but also because of its relationship to the pitch test.[27]

Intercorrelations of the Seashore Measures of Musical Talent

Seashore believed that each of the sub-tests measured different factors in musical ability. He employs an atomistic approach to the study of musical talent. This technique is based on an analysis of musical talent into many independent factors. He states:

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[26] Ibid., p. 445.

[27] Ibid., p. 454.

> No matter how many members we have in a battery, each member remains a specific measure; that is, the technical validation must be made in terms of the thing measured in each one. The more members of basic significance we have in the battery, the larger command of the situation it should give. This is what we have called the specific theory of measurement as opposed to the omnibus theory which aims to validate the battery against the total situation in musical performance.[28]

Studies reviewed by Farnsworth[29] show low intercorrelations, substantiating Seashore's viewpoint. Farnsworth presents the following figures based on Seashore and Mount's 1916 data:

	Intensity	Time	Tonal memory
Pitch	.09	.17	.52
Intensity		.15	.26
Time			.17

Wilson's study also agrees with Farnsworth's. He states:

> Variables which are to be used in prediction equations should produce low intercorrelations among themselves and high correlations with the criteria. In order to determine the degree of intercorrelation between the predictors, Pearson r's were computed. The Pearson r between Loudness and Tonal Memory was .27; between Timbre and Tonal Memory, .23. These rather low intercorrelations were encouraging and it seemed that a combination of the Seashore variables should have maximum effectiveness in the prediction formula.[30]

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[28] Carl Seashore, et al., Manual of Instructions and Interpretations for the Seashore Measures of Musical Talents (Iowa City: University of Iowa Press, 1940), p. 48.

[29] Paul Farnsworth, "An Historical Critical, and Experimental Study of the Seashore-Kwalwasser Test Battery," Genetic Psychology Monographs, IX (May, 1931), 318-25.

[30] Wilson, p. 40.

McCarthy also obtained low intercorrelations, bearing out Seashore's contention. She found:

> The highest correlations for all groups are those between pitch and memory. This is probably due to the fact that pitch discrimination enters into the memory test. When the subjects are asked to tell which of a series of tones is changed, it is the pitch of one of the tones in the series which is changed. The pitch discriminations involved in the memory test are not fine but this factor undoubtedly enters into the memory scores for those who are poor in pitch discrimination. Of the ten lowest persons in the experimental class in pitch discrimination eight are below the first quartile in the memory test. [31]

Personality Scale of Manifest Anxiety

Taylor's manifest anxiety scale has been in use since 1948 and has been the subject of a great deal of research. In 1951 the scale was used in a study of eyelid conditioning. "On the assumption that variations in what is described psychiatrically as 'manifest anxiety'[32] reflect variations in generalized levels of drive, a test of manifest anxiety was constructed for the purpose of selecting Ss for the experimental groups."[33]

> Approximately two hundred items from the Minnesota Multiphasic Personality Inventory were submitted to five clinicians, along with a definition of manifest anxiety that followed Cameron's description of chronic anxiety reactions. The judges were asked to designate the items indicative of

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[31] McCarthy, p. 453.

[32] Manifest anxiety identifies a group of widespread, directly observable overt reactions (e. g., restlessness, tenseness, etc.) assumed to be accompanied or paralleled by internal emotional responses primarily controlled by the autonomic nervous system. Janet Taylor, "The Relationship of Anxiety to the Conditioned Eyelid Response," Journal of Experimental Psychology, XLI (February, 1951), 90.

[33] Ibid., p. 84.

> manifest anxiety according to the definition. Sixty-five items on which there was eighty percent agreement or better were selected for the anxiety scale.[34]

These sixty-five items, plus 135 "buffer" items from the Minnesota Multiphasic Personality Inventory were administered in group form to 352 students in a course in Introductory Psychology. The experiment attempted to evaluate the hypothesis that " . . . the amount of conditioning exhibited in a defense conditioning situation is a direct function of the level of total effective drive.[35] Two groups were chosen on the basis of extreme scores made on the anxiety test. Those with high scores (high drive) and those with low scores (low drive) were used in a conditioned eyelid situation.

> The data from the anxious and non-anxious groups show that the anxious group was consistently superior in amount of conditioning throughout the course of the conditioning trials, the difference between the two groups being highly significant statistically.[36]

Another study by Taylor was designed to test the hypothesis that "the total effective drive strength (D) of a subject was, in part, a function of the level of internal anxiety or emotionality of the subject, and the level of this internal emotional state would, in turn, be reflected by the responses made in a test of so-called manifest anxiety."[37]

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[34] Janet Taylor, "A Personality Scale of Manifest Anxiety," Journal of Abnormal and Social Psychology, XLVIII (1953), 285.

[35] Taylor, XLI, p. 91.

[36] Ibid.

[37] Janet Taylor and Kenneth Spence, "The Relationship of Anxiety Level to Performance in Serial Learning," Journal of Experimental Psychology, XLIV (August, 1952), 61.

Specifically, it was felt that the performance of anxious (high-drive) subjects would be inferior to that of non-anxious (low-drive) subjects in a learning situation involving competing responses.

> Both groups were run in a serial learning situation involving the presentation of a series of twenty choices between two verbal responses, saying "left" or "right" at each point of choice in a memory drum set-up. The criterion of learning was two successive trials in which S successfully anticipated the correct response at each choice point.[38]

The results showed that the anxious group made a significantly greater number of errors and required a larger number of trials to reach the learning criterion, confirming the hypothesis.

> It was also found that the points of choice that were most difficult and hence presumably involved the most competition from erroneous response tendencies provided the greatest differences between the two groups.[39]

The anxiety scale has been modified several times since its inception. "At present it consists of fifty of the original sixty-five items that showed a high correlation with the total anxiety scores in the original group tested."[40]

Summary

The following points summarize the studies reviewed in this chapter:

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[38] Ibid., p. 64.

[39] Ibid.

[40] Taylor, XLVIII, 285.

1. Studies of the relationship of the Seashore Measures to musical attainments yield positive, but low, correlations, indicating little predictive usefulness of the Measures. Many researchers seem to be in agreement with McCarthy. She states:

> The Seashore Tests are of the greatest practical value at the extremes of the scale and as is the case with most measures of vocational aptitude it is much easier to predict failure than it is to predict success. [41]

2. In general, studies of intelligence for prediction of success in music as opposed to the Seashore Measures, yield low correlations. Most researchers seem to be in agreement from their findings that the Seashore Measures are a better predictor of success in music than intelligence scores. However, many of the results substantiate Seashore's contention that intelligence is a good supplement for the prediction of success in music students.

3. In general, Seashore scores remain stable with the exception of Tonal Memory, which suggests the influence of maturation or training on this ability.

4. Studies reviewed show low intercorrelations among the Seashore sub-tests. This indicates that they measure different factors in musical ability, substantiating Seashore's contention.

5. Two studies utilizing the Taylor Manifest Anxiety Scale were reviewed. One showed what the scale measures positively, and the other what it measures negatively.

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[41] McCarthy, p. 454.

CHAPTER III

SUBJECTS AND PROCEDURE

This chapter describes the subjects and materials used in the study, the procedure, and the statistical treatment of the data.

Subjects

Three groups of undergraduate students served as subjects in the study. Group I was composed of 48 students enrolled in Applied Phonetics (Speech 375) Spring term 1957. Group II was composed of 40 students enrolled in Applied Phonetics in either the Fall of 1956 or Winter 1957 term. All the students in groups one and two were taught by the same professor of Phonetics. Group III was composed of 39 students enrolled in two sections of Voice and Diction (Speech 208) Spring term 1957. One Voice and Diction instructor taught both of these sections. The Phonetics students participating in the study represent a one-year's cross-section of majors from all areas of speech specialization, plus a negligible number of non-speech majors. The majority of the enrollment in Voice and Diction consisted of non-speech majors.

Materials and Equipment

The following test materials and equipment were used in the study:

1. The Seashore Measures of Musical Talents, 1939 Revision, Series B, are presented on three twelve-inch double-faced 78 r. p. m. RCA Victor records. Each of the sub-tests appears on one side of a record. The six sub-tests are: Pitch, Loudness, Rhythm, Time, Timbre and Tonal Memory. Auditory stimuli are presented in pairs which require the subject to respond by making an either-or decision. The test of Pitch requires the subject to determine, in each pair, whether the second tone is higher or lower in pitch than the first. The Loudness test requires the subject to determine whether the second tone is stronger or weaker than the first. For Rhythm the subject indicates whether the two patterns in each pair are the same or different. The Time test requires the subject to determine whether the second tone is longer or shorter than the first. The subject is required to judge whether the tones are the same or different in tone quality for the test of Timbre. For Tonal Memory there are thirty pairs of tonal sequences consisting of four-, five-, and six-tone groups. Within each pair one tone in the second sequence differs in pitch from its corresponding tone in the first sequence. The subject must identify which note it is by the number of its position in the sequence.

It should be noted that Series A and B measure the same capacities. They both require a "limenal" type of judgment. However in Series B the intervals are smaller and require finer discrimations on the part of the subject. Since achievement (as measured by the final grade) in phonetic transcription requires the individual to discriminate

and transcribe precise sounds, it was felt that Series B would more adequately meet the requirements for the study. Prior research, reviewed in Chapter II, also utilized Series B.

2. Two phonographs were used to conduct the testing. A Newcomb three-speed phonograph, Model TR-16 was used for the pre-testing. A Newcomb three-speed phonograph, Model R-12 was used for post-testing. Mechanical failure prevented the use of the first machine for the post-testing.

3. Standard test blanks published by the Educational Department of the RCA Manufacturing Co., Inc., Camden, New Jersey were used in the study.

4. Personality Scale of Manifest Anxiety. This is a paper-pencil test consisting of 50 items taken originally from the Minnesota Multiphasic Personality Inventory. Each item requires a true or false answer. Many of the statements in the scale were modified by Janet Taylor at the University of Iowa to minimize possible misunderstanding. The test and its modifications are explained in detail in Chapter II.

5. Michigan State University Orientation Test scores. This battery, administered to all incoming students at Michigan State University, is a series of tests used to obtain an index of an individual's abilities. Scores on these tests were obtained from the Michigan State University Office of Evaluation Services for all subjects used in the study. Since there is no single derived score as an index of ability, all eight scores were used in this study. In this way each of the

abilities measured by the battery could be considered and compared with the other tests included in the study. The tests are:

1) Arithmetic (A)

   The Arithmetic Proficiency Test consists of forty-five problems in basic arithmetic. It is designed to detect students who are deficient in basic arithmetical skill.

2) ACE--Quantitative (Q)

3) ACE-Language (L)

4) ACE-Total Score (PT)

   "The ACE Psychological Examination seeks to measure scholastic aptitude, i.e., the mental alertness component in college success. The test yields three scores: Quantitative (Q), Language (L), and Total Score (PT). The Q-Score is sometimes more closely related to success in selected technical subjects than the L-Score, but the L-Score is usually the more predictive of the two scores for the large majority of the curricula."[1] The Total Score is considered a measure of general college ability.

5) English (E)

   "The MSU English Placement Test consists of thirty objective test items representing many aspects of English usage. Included are items on spelling, capitalization, grammar, punctuation, sentence structure, and organization. The test is primarily designed to identify students who may require assistance from the Writing Improvement Service."[2]

6) Reading (Vocabulary) (V)

7) Reading (Comprehension) (C)

8) Reading (Total Score) (RT)

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[1] The Use of Orientation Test Data, Testing Bulletin No. 3, Prepared by the Office of Evaluation Services, The Basic College (East Lansing, Michigan State University, 1957), p. 2.

[2] Ibid.

> The MSU Reading Test is a 97-item test which yields a Vocabulary (V), a Comprehension Score (C) and a Total Reading Score (RT). The vocabulary portion consists of fifty test items, while the Comprehension Score is based on the student's ability to answer forty-seven questions concerning several reading passages involving concepts typical of several academic areas at MSU. Many factors involved in critical thought are undoubtedly assessed in this measure of reading proficiency. [3]

6. Transcription scores. These scores were derived from orally dictated, twenty-word tests, given periodically throughout the term. The average of these scores for each individual was used as criterion measures in this study.

7. IBM card data sheets. These are mimeographed sheets used to code the data for use in punching the IBM cards.

8. IBM cards. These are standard (Astco 72x77) IBM cards.

9. A standard IBM Key Punch, Model 024, was used in the study.

10. A standard IBM Card Verifier, Model 156, was used to verify the cards.

11. IBM equipment used to process the raw data were the Model 604 machine, a Card Sorter and a Tabulator.

12. Marchant calculators were used to complete the computations.

Procedure

The Seashore Measures of Musical Talents were administered to all Spring term sections of Applied Phonetics and two sections of Voice

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[3] Ibid.

and Diction during the first week of Spring term 1957. The experimenter obtained preliminary practice in the administration of this test by means of trial runs with small groups of speech students.

Post cards were sent to all students who had previously enrolled in Applied Phonetics either Fall or Winter term during the academic year 1956-57. The students were requested to choose one of the hours listed on the card to participate in the research program. Testing for this group was conducted during the week of April 30th.

All subjects were seated within ten feet of the sound source. The testing was conducted in the same classrooms used for the teaching of Applied Phonetics and Voice Diction. It was felt that in duplicating the actual classroom situation the results would be comparable to the Seashore norms. The windows were closed to minimize external noise.

Test blanks were passed out and the students were instructed to record their name and student number. The subjects were told that the purpose of the test was to determine certain aspects of hearing. Standard instructions for each Measure, as given in the Manual of Instructions were read preceding the playing of each sub-test. Also preceding each sub-test, three pairs of stimuli from the corresponding Measure in the Series A records were played. These stimuli served as practice to make sure everyone understood the directions, and to adjust the volume control of the phonograph. The six sub-tests were administered consecutively in the order of the sequence on the records.

The Fall and Winter term Applied Phonetics students were given the anxiety scale following the Seashore. They were instructed to put their names on the paper, read the questions carefully, and circle either true or false for each question.

The Seashore was again administered to Spring term Applied Phonetics and Voice and Diction sections during the last week of the term.[4] These students were also given the anxiety test at that time. The directions given were the same as those cited above.

All test blanks and anxiety scales were scored by the experimenter. The transcription scores for all Phonetics students used in the study were obtained from the instructor. The Michigan State University Orientation Test scores for all subjects participating in the study were obtained from the MSU Office of Evaluation Services.

The original raw data were transferred from a code sheet to punch cards by means of the IBM Key Punch, and verified by the IBM Card Verifier. The IBM Card Sorter was used to separate the cards into the various categories. The IBM 604 and Marchant Calculators were used to compute all of the correlations and *t*'s required in the analysis of the data.

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[4] These tests will hereafter be referred to as the "post-Seashores." The tests taken at the beginning of the term will be referred to as "pre-Seashores."

Statistical Treatment

Pearson Product-Moment correlations[5] will be computed to ascertain the relationships between transcription grades and (a) Achievement Battery scores, (b) Taylor Anxiety scores, and (c) pre-Seashore scores to ascertain whether any of these tests have predictive value.

A *t* statistic will be computed on the pre-Seashore scores to ascertain whether the two groups of students--Phonetics and Voice and Diction--are representative of the same population. An **F**-test will precede to determine whether the assumption of homogeneity of variance may be made.

The *t* statistic will be computed to test pre-post differences of the Seashore sub-tests for both Group I Phonetics and Voice and Diction students to ascertain stability of the Seashore. These tests will be preceded by **F**-tests for homogeneity of variance.

Correlations will be obtained on pre-post Seashore scores for both Phonetics and Voice and Diction students to ascertain whether the internal rank-ordering of the students remained the same within each group. A z-transformation will be employed to test whether the changes in rank-ordering differed between the two groups.

A *t* test will be made to determine whether any of the Seashore change scores differ significantly between Phonetics and Voice and Diction students.

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[5]All correlations in this study will be Pearson Product-Moment correlations, or multiples employing Pearson r's.

Intercorrelations will be made of all Seashore sub-tests and of all Achievement Battery scores. Intercorrelations will be computed between Seashore Measures and Achievement Battery scores.

Multiple correlations will be computed on all of the Seashore scores with transcription grades. Multiples will also be computed with the transcription grades and all combinations of five Seashore scores (removing one Seashore measure at a time).

The McQuitty Elementary Linkage Analysis will be employed to isolate types (or factors) for use in further multiple correlation. Using these results, multiple correlations will be run to ascertain the best possible predictive-pairing.

A prediction equation will be derived and the confidence interval established.

CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

The Relationship between Achievement and Phonetic Transcription

In an effort to determine the most effective measure which would prove valuable in predicting success in Applied Phonetics, a correlation was computed between each of the Orientation test scores (hereafter called "Achievement Battery scores") and transcription grades. The results are presented in Table 1.

TABLE 1.--Correlation coefficients obtained between Achievement Battery scores and transcription grades of both groups of Phonetics students (N=88)

Achievement Battery		r
English	(E)	.42**
Arithmetic	(A)	.19
Quantitative	(Q)	.07
Language	(L)	.36**
Total ACE	(PT)	.27*
Vocabulary	(V)	.32**
Comprehension	(C)	.28**
Total Reading	(RT)	.34**

*Significant at the 5% level
**Significant at the 1% level

Inspection of Table 1 shows that the correlation coefficients obtained between achievement and transcription scores were positive and significant for the tests of English, Language, Total ACE, Vocabulary, Comprehension, and Total Reading. This would suggest predictive value

for these tests. The only correlations not significant were those between Quantitative Thinking and Transcription, and Arithmetic and Transcription, suggesting that numerical ability is not crucially related to success in phonetic transcription.

The Relationships between Anxiety and Transcription and Anxiety and the Seashore Scores

A correlation was computed between transcription grades and Taylor anxiety scores for all Applied Phonetics students participating in this study. The correlation coefficient obtained was .11. This result was not statistically significant and would suggest that the anxiety test will have little value as a phonetics success-predictor.

The Anxiety scores of the Phonetics students were also correlated with the Seashore scores. None of the correlations were significantly different from zero for the Seashore and Anxiety. Anxiety was used as one of the possible predictors and didn't prove significant, nor was it related significantly to any of the Seashore Measures.

The Relationship between the Seashore Measures and Transcription

The correlations between pre-Seashore scores and transcription grades are presented in Table 2.

TABLE 2. --Correlation coefficients obtained between pre-Seashore scores and transcription grades of Group I Phonetics students (N=48)

Seashore	r
Pitch	.36*
Loudness	.31*
Rhythm	.40**
Time	.48**
Timbre	.40**
Tonal Memory	.48**

*Significant at the 5% level
**Significant at the 1% level

Inspection of Table 2 shows positive correlation coefficients significantly different from zero at the one percent level between transcription grades and the Seashore Measures of Rhythm, Time, Timbre and Tonal Memory. A correlation coefficient significant at the five percent level was obtained between transcription grades and the Pitch and Loudness Measures. These results indicate that a positive and significant relationship exists between the Seashore Measures and transcription, and hence suggests predictive value of the Seashore Measures.

Although the relationships were positive and significant, the greatest amount of variability which can be accounted for with any of the sub-tests is 23% (the square of the highest correlation). This figure is actually very low for predictive purposes, but it would probably be sufficient to separate the poor and the excellent students from the group in general.

Before computing a *t* statistic to determine initial differences of the Phonetics and Voice and Diction students, an F-ratio was computed to determine whether the variance of the pre-Seashore scores was homogeneous. The results permit the assumption of homogeneity of variance for the Seashore Measures of Pitch, Rhythm, Time, Timbre and Tonal Memory. The variance was significantly different at the one percent level for the Measure of Loudness, the Applied Phonetics students demonstrating the greater variance. Since individual variance was so great in the Loudness sub-test, no between-group test was applied to the data for this particular sub-test.

A *t* statistic was computed between the pre-Seashore scores (other than "Loudness") of the Phonetics and Voice and Diction students to determine whether or not they were representative of the same population with respect to the abilities tested by the Seashore Measures. The results of the *t* are presented in Table 3.

TABLE 3. --*t* values between pre-Seashore scores of Phonetics students and pre-Seashore scores of Voice and Diction students

Seashore	$\bar{X}_{375}$	$\bar{X}_{208}$	$\bar{X}_{375} - \bar{X}_{208}$	*t*
Pitch	34.15	30.56	3.59	2.31*
Rhythm	24.10	23.28	.82	1.27
Time	33.88	34.05	-.17	-.18
Timbre	39.15	37.31	1.84	1.57
Tonal Memory	22.10	18.72	3.38	2.61*

*Significant at the 5% level

Inspection of Table 3 shows no difference between the Phonetics and Voice and Diction students for the Seashore Measures of Rhythm, Time and Timbre. However, the means of the Phonetics students were significantly higher than the means of the Voice and Diction students for the sub-tests of Pitch and Tonal Memory.

Although the data yield no factual explanations for the differences occurring between the two groups for Pitch and Tonal Memory, a tentative explanation can be advanced. It has been mentioned previously that the majority of the Phonetics students are speech majors, while the majority of the Voice and Diction students are non-speech majors. Many of these speech majors began their training in high school by participating in dramatics, speaking contests, etc. This type of training requires a great deal of memorization. It also requires voice training for variability in pitch levels, etc. The training of speech majors at Michigan State University reinforces and advances these abilities. It might therefore be hypothesized that the training these students had received in high school and college explains the difference between the two groups for the tests of Pitch and Tonal Memory.

Stability of the Seashore Measures

In order to ascertain whether significant changes occurred between the pre- and post-Seashore scores, F-ratios were computed to test for homogeneity of variance. None of these tests were significant

for the Voice and Diction students. Accordingly, a *t* statistic was computed between pre- and post-Seashore scores for the Voice and Diction students to ascertain whether a significant change occurred during the time interval of the course. The results of the *t* are presented in Table 4.

TABLE 4. --*t* values between pre- and post-Seashore sub-tests for Voice and Diction students (N=39)

Seashore	*t*
Pitch	.68
Loudness	-1.87
Rhythm	- .81
Time	-1.24
Timbre	1.70
Tonal Memory	2.76**

**Significant at the 1% level

Inspection of Table 4 shows that the only significant change (improvement) occurred on the "Tonal Memory" sub-test. This finding is in accord with Seashore's statements that the one factor measured by his test which is subject to improvement with training is that of Tonal Memory. However this significant improvement--if due to taking the voice and diction course--comes as a special dividend, since no overt effort was made in this course to improve tonal memory span as such.

For the Phonetics students, an F-ratio, significant at the 1 percent level, was obtained on the Loudness sub-test. Accordingly, no test was made of the group means on this Seashore sub-test.

The assumption of homogeneity of variance was supported by the F-ratios computed on the remaining Seashore sub-tests.

For each of these a t statistic was computed between pre- and post-Seashore scores to ascertain whether a significant change occurred during the time interval of the Phonetics course. The results of the t are presented in Table 5.

TABLE 5. --t values between pre- and post-Seashore sub-tests for Group I Phonetics students (N=48)

Seashore	t
Pitch	1.83
Rhythm	- .43
Time	1.51
Timbre	2.30*
Tonal Memory	1.10

*Significant at the 5% level

Inspection of Table 5 shows that one significant change occurred. This was a significant improvement on the "Timbre" sub-test. This finding is of particular importance inasmuch as Seashore contended that the qualities measured by these tests--except for Tonal Memory--were relatively stable and not subject to change. This improvement could be rationalized as due to the phonetic training, since the tests administered in this course placed extremely great emphasis on vowel differentiation. Since vowels are resonance--or timbre--phenomena, it would seem that the emphasis on hearing vowel differences in the phonetics course could be the reason for the significant improvement of this group on the Timbre sub-test.

A probable reason for failure to achieve a significant change in Tonal Memory, as in the case of the Voice and Diction group, is the original high level of ability of the Phonetics students (see Table 3). It is also possible that the two courses could have affected scores on this sub-test differently.

A correlation was computed between pre- and post-Seashore scores of the Group I Phonetics students to determine whether the same internal rank order was maintained within the group. The results of the computation are presented in Table 6.

TABLE 6. --Correlation coefficients obtained between pre- and post-Seashore scores of Group I Phonetics students (N=48)

Seashore	r
Pitch	.45**
Loudness	.31*
Rhythm	.46**
Time	.39**
Timbre	.55**
Tonal Memory	.83**

*Significant at the 5% level
**Significant at the 1% level

It can be concluded from inspection of Table 6 that the rank ordering of subjects on the Tonal Memory sub-test changed less from pre- to post-testing than for the other sub-tests. The measure of Loudness presented the greatest rearrangement of individual scores within the group.

A correlation was also computed between the pre- and post-Seashore scores of the Voice and Diction students to determine whether the internal rank order within the group remained the same. The results of the computation are presented in Table 7.

TABLE 7.--Correlation coefficients obtained between pre- and post-Seashore Scores of the Voice and Diction students (N=39)

Seashore	r
Pitch	.27
Loudness	.70**
Rhythm	.69**
Time	.71**
Timbre	.58**
Tonal Memory	.87**

**Significant at the 1% level

Inspection of Table 7 shows positive correlation coefficients significantly different from zero at the one percent level for the Measures of Loudness, Rhythm, Time, Timbre and Tonal Memory. The Pitch correlation was not significant at the five percent level. Just as with the group of Phonetics students, it was the Tonal Memory rank ordering which changed less from pre- to post-testing than did the scores for any of the other sub-tests. The measure of Pitch represented the greatest rearrangement of individual scores within the group indicating that some of the Voice and Diction students made significant improvements in Pitch perception while others did not, during the course of the experiment.

To test the hypothesis that the correlations determining rank order were the same for Phonetics and Voice and Diction students a z transformation was computed. This test was made to determine whether variation in rank-ordering differed between the Voice and Diction and Phonetics students over the interval between pre- and post-testing. The results are presented in Table 8.

TABLE 8.--Ratio of the difference between z transformations of pre-post Seashore correlation coefficients of Group I Phonetics students and of Voice and Diction students to its standard error

Seashore	z
Pitch	.929
Loudness	-2.438*
Rhythm	-1.567
Time	-2.121*
Timbre	- .201
Tonal Memory	- .647

*Significant at the 5% level

It is apparent that the two groups of students differed significantly in their change of rank ordering from pre-test to post-test for the Seashore Measures of Loudness and Time. In both of these instances, the greater change occurred in the group of Phonetics students. This result might be due to the specific concentration devoted to loudness and time in the Phonetics class in differentiating stressed versus unstressed sounds--plus the wide spread of transcription grades which indicates considerable intra-group differences in achieving this skill.

Conversely, the results presented in Table 8 indicate that the Phonetics and Voice and Diction students did not differ significantly in their change in rank ordering on the Seashore Pitch, Rhythm, Timbre and Tonal Memory sub-tests.

Carl Seashore[1] maintained throughout his research with the Seashore sub-tests that they should be regarded as separate tests, measuring different factors. He also felt that the abilities measurable with the sub-tests were innate, and scores should not change due to training. The exception to this is Tonal Memory, which is a factor that improves (lengthens) through experience and education.

An F-ratio was computed between the change scores of the Phonetics and Voice and Diction students to determine whether the mean variance was the same for the two groups. The results of the F-ratio showed that the mean variance was the same for the Phonetics and Voice and Diction students on the Seashore Measures of Rhythm, Timbre and Tonal Memory. The variances were significantly different at the five percent level between the two groups for the Measures of Pitch and Time, and at the one percent level for the Loudness Measure. The variance was greater for the Voice and Diction students on the Pitch Measure. The variance was greater for the Phonetics students on the Measures of Loudness and Time. Suggested explanations have been advanced for these differences when discussing the significant

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[1] Seashore, The Psychology of Musical Talent, p. 236.

changes in rank-orderings of subjects for the measures of Pitch, Loudness and Time.

A *t* statistic was computed between the change scores of the Rhythm, Timbre and Tonal Memory Seashore Measures for the Phonetics and Voice and Diction students to determine whether or not the changes between pre- and post-Seashore scores of Phonetics differed significantly from the same changes for Voice and Diction. None of the differences were significant, hence indicating that the magnitude of the mean changes did not differ significantly between the two groups.

The *z* transformation computed between the pre- and post-Seashore correlation coefficients of the Phonetics and Voice and Diction students determined whether the interrelationships with the groups were comparable from group to group. Reference to Table 8 shows that the correlations were not the same for the Measures of Loudness and Time. However, since the *t*'s computed (testing the difference between the change scores of Phonetics and Voice and Diction students) show no significant differences between change scores for the two groups, it can be assumed that although individuals showed considerable variability for Loudness and Time between the two groups, these changes were cancelled in comparing group means.

In view of these findings, and since the Phonetics and Voice and Diction subjects were not matched on the basis of their original (pre-) Seashore scores, we are not in a position to stress the

differences between course results which appeared tenable on previously-discussed *t* tests. Perhaps larger samples might reveal similar significant Seashore changes after completing the opposite course.

However, because of these results, added *t* tests were run on the Phonetics and Voice and Diction groups combined to afford a larger "N" in order to further test the stability of these measures.

The results are presented in Table 9.

TABLE 9.--*t* values between pre- and post-Seashore sub-tests for Group I Phonetics students and Voice and Diction students combined (N=87)

Seashore	*t*
Pitch	1.72
Loudness	-1.36
Rhythm	- .84
Time	.56
Timbre	2.87**
Tonal Memory	2.61*

*Significant at the 5% level
**Significant at the 1% level

The results of testing this larger sampling further confirm the change in the Timbre and Tonal Memory sub-tests, thus questioning the stability of these measures.

The tables presented thus far are results of tests which have been computed to determine not only existing relationships between the various tests, but also to serve as aids toward the goal of a predictor for success in Applied Phonetics.

Predicting Success in Phonetic Transcription

To determine the relationship between each of the Seashore Measures correlations were computed. The results are presented in Table 10.

TABLE 10. --Intercorrelation of the pre-Seashore Measures for the Group I Phonetics students (N=48)

	Loudness	Rhythm	Time	Timbre	Tonal memory
Pitch	.51**	.12	.27*	.31*	.45**
Loudness		.01	.34*	.13	.13
Rhythm			.49**	.24	.34*
Time				.32*	.27*
Timbre					.43**

*Significant at the 5% level
**Significant at the 1% level

The results presented in Table 10 show that, contrary to Seashore's views, the tests do appear to be interrelated. Loudness and Rhythm are the only tests having a minimal relationship to the other Measures. But even these sub-tests show significant relationships with two of the five other sub-tests. These results suggest that there is some degree of overlap in some of the tests and that they are not completely independent measures.

A correlation was also computed to determine the interrelationships for the Achievement Battery scores. The results are presented in Table 11.

TABLE 11. --Intercorrelation of the Achievement Battery scores for all Phonetics and Voice and Diction students combined

	A	Q	L	PT	V	C	RT
E	.45	.28	.60	.54	.42	.26	.37
A		.52	.46	.54	.34	.24	.43
Q			.49	.80	.32	.40	.37
L				.87	.65	.51	.61
PT					.54	.48	.58
V						.56	.87
C							.85

All of the correlation coefficients in Table 11 are significant at the one percent level. This indicates that the tests are interrelated and not completely independent measures.

A correlation was computed between the Seashore Measures and the Achievement Battery scores to determine whether a relationship exists.

TABLE 12. --Intercorrelation between the pre-Seashore Measures and the Achievement Battery scores for the Group I Phonetics and Voice and Diction students combined

	E	A	Q	L	T	V	C	RT
Pitch	.24*	.20	.06	.25*	.19	.33**	.12	.33**
Loudness	.05	.18	.14	.003	.09	.06	.05	.16
Rhythm	.33**	.34**	.37**	.43**	.41**	.40**	.29**	.44**
Time	-.008	.12	.10	-.07	.01	.06	.003	.14
Timbre	.24*	.23*	.32**	.26*	.28**	.36**	.05	.31**
Tonal Memory	.40**	.13	.27*	.35**	.33**	.32**	.25*	.36**

*Significant at the 5% level
**Significant at the 1% level

Inspection of Table 12 shows that neither Loudness nor Time correlated significantly with any of the Achievement Battery scores. Since four of the six Seashore sub-tests showed significant correlations with many of the Achievement Battery sub-tests, it seems that some of these could supplement the Seashore Measures as predictors.

Tables 10, 11 and 12 have presented the existing inter-relationships among and between the Seashore Measures and the Achievement Battery scores. It is apparent that only part of the scores will be useful for prediction purposes, since many of them appear to measure similar qualities.

Using the pre-test scores of the Group I Phonetics students, multiple correlations were computed using all possible combinations of the Seashore tests. The results of these computations are presented in Table 13.

TABLE 13.--Multiple correlations using the pre-Seashore scores of the Group I Phonetics students (N=48)

$r_{1.234567}$	.65	All six Measures
$r_{1.23456}$	.61	Memory removed
$r_{1.23457}$	.63	Timbre removed
$r_{1.23467}$	.62	Time removed
$r_{1.23567}$	.64	Rhythm removed
$r_{1.24567}$	.63	Loudness removed
$r_{1.34567}$	.65	Pitch removed

The results presented in Table 12 show that together the Measures yield a coefficient of .65. Removing each of the Measures one at a time causes only a very slight change in coefficients obtained.

All of the intercorrelations presented in Tables 10 through 12 were combined into one matrix for the purpose of further study by means of McQuitty's Elementary Linkage Analysis.[2] The ACE-total score (PT) and the Reading total score (RT) were eliminated from the determination of types, since both of these scores include measures of traits which are measured by other of the Achievement Battery subtests.

It would appear from this analysis that there are four types (or factors): One verbal (E, L, V and C), one numerical (A and Q), one Seashore cluster including Rhythm and Time, and a second Seashore cluster including Pitch, Tonal Memory, Timbre and Loudness. Because of the low correlations of both A and Q with transcription, this "numerical" type was dropped from further consideration in the correlation analysis.

A series of two-variable multiple correlations[3] were run to ascertain the best possible predictive-pairing. The best overall

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[2]Louis L. McQuitty,"Elementary Linkage Analysis for Isolating Orthogonal and Oblique Types and Typal Relevancies," Educational and Psychological Measurement, Vol. 17, No. 2 (Summer, 1957), 207-229.

[3]Alan E. Treloar, Correlation Analysis (Burgess Publishing Co., 1942), Formula 10, p. 24.

two-variable prediction was Time and English (r = .64), with Time and Language (r = .62) almost as good. The best two-variable multiple from the Seashore tests alone was Time and Tonal Memory (r = .60). (Individually, these sub-tests were also the best single-variable predictors.)

Not much improvement seems apparent beyond a two-variable correlation (i.e., on the basis of matrix-inspection, a third type cannot be found which will correlate high with the criterion measure--Transcription--but low with both Time and English). Additional evidence for not exceeding a two-variable correlation appears in Table 13 where even six variables did not yield a significantly better multiple correlation.

Since the differences between the best two-variable correlations were so small, the prediction equation[4] was computed using the two Seashore variables Time and Tonal Memory.

The constants yielded by this computation appear in the following prediction equation:

$$X'_1 = 1.671\, X_2 + 1.413\, X_3 - 11.518$$

where: X'_1 = Transcription (predicted)

X_2 = Time

X_3 = Tonal Memory

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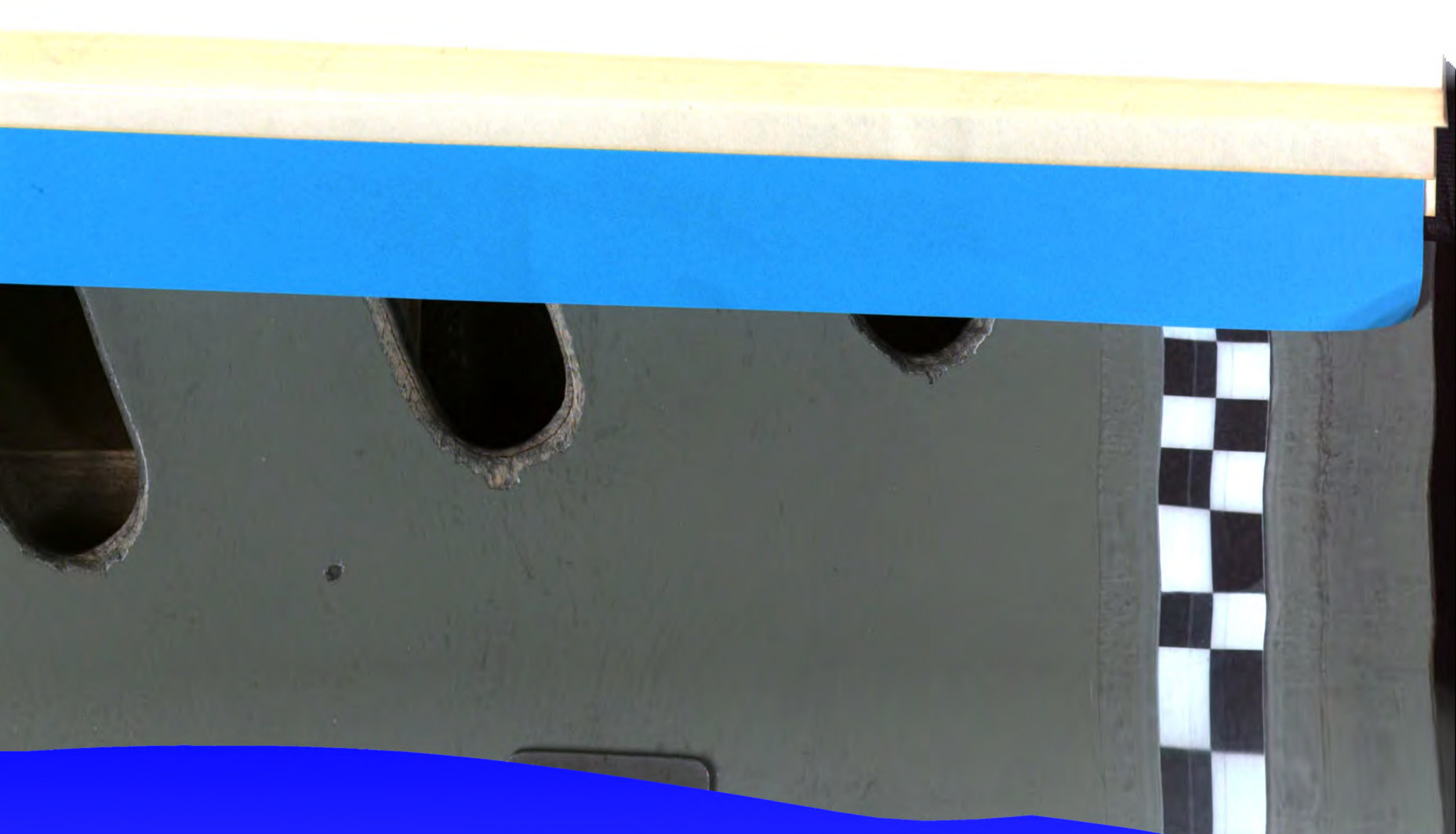
[4] Quinn McNemar, Psychological Statistics (John Wiley & Sons, Inc., Second edition, 1955), Formula 66, p. 174.



The standard error of the predictions is 16.28.[5] Hence 95 percent of the cases will fall in the range of plus or minus 32 raw score points. Thus, as in other "prediction" studies utilizing the Seashore measures, the error in predicting the criteria is somewhat large, limiting the formula's usefulness for individual predictive purposes.

However, the formula does represent somewhat--though not much--of an improvement over predictions based on the mean score plus or minus twice the standard deviation of the transcription scores.

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[5] J. P. Guilford, Psychometric Methods (McGraw-Hill Book Company, Inc., First edition, 1936), p. 392.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

This chapter deals with the conclusions and implications drawn from the results presented in Chapter IV.

Arithmetic and Quantitative Thinking, as measured in this study, did not correlate significantly with the transcription grades of the Phonetics students studied. It may be concluded that numerical ability is not directly related to success in phonetic transcription. On the other hand, the skills or abilities tested by the remaining tests of the MSU Achievement Battery appear to be significantly related to success in phonetic transcription.

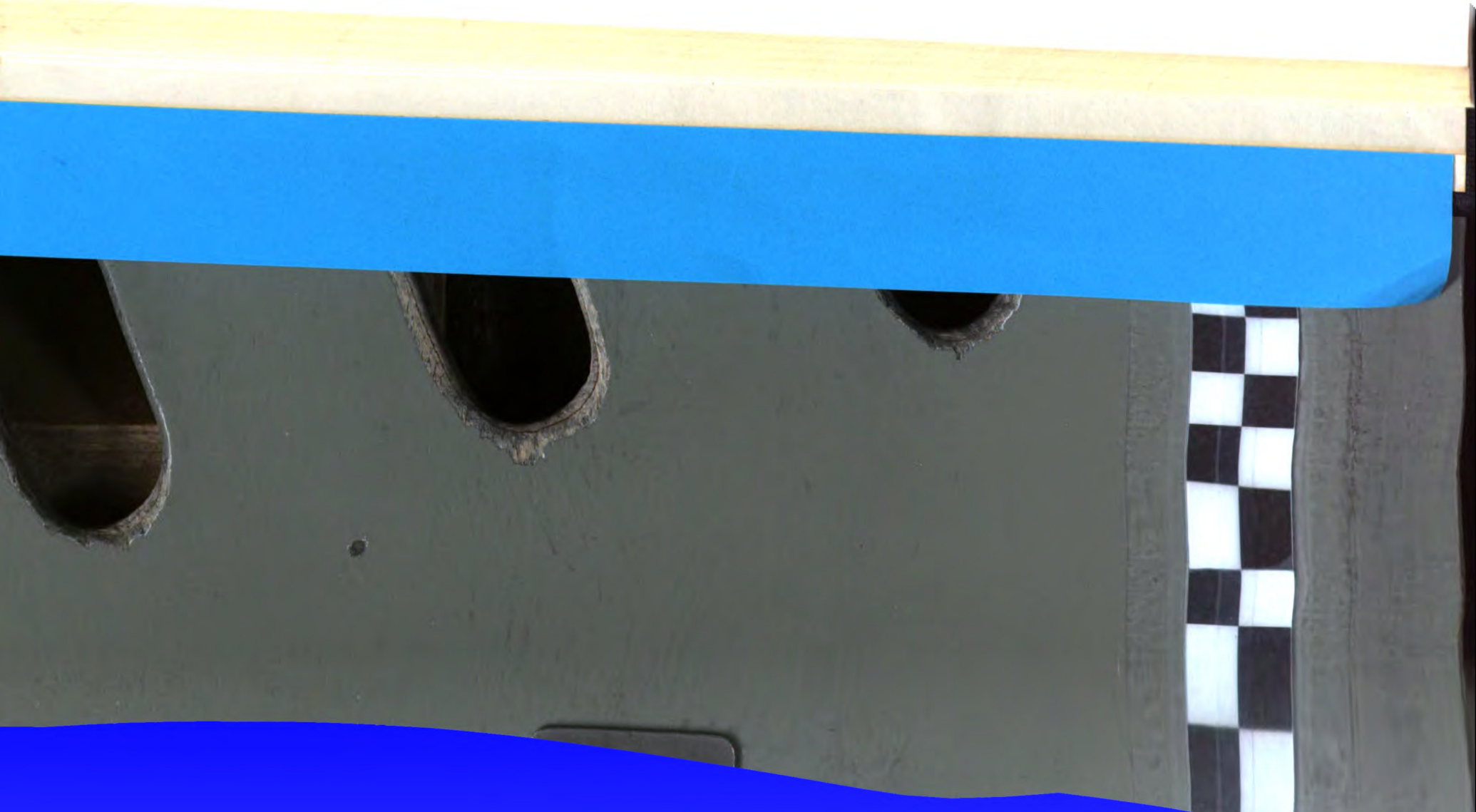
Because phonetic transcription demands discrimination between closely related sounds and requires the use of specific symbols without chance for equivocation, it was felt that the students' anxiety levels might be correlated with their ability to succeed in phonetic transcription skills. The low correlation observed between transcription scores and the anxiety scores negates the usefulness of Taylor anxiety scores for predictive purposes. The findings of the present study, however, do not completely veto the possibility of a relationship between anxiety and phonetic skill. It is possible that the Taylor scale is not sufficiently discriminatory. It is also possible that specific anxieties are momentarily aroused during the taking of transcription which would not be revealed in a "generalized" anxiety concept as is reputed to be measured by the Taylor scale.

It was observed that the Voice and Diction students improved on the "Tonal Memory" sub-test, while the Phonetics students improved on the "Timbre" sub-test. Possible explanations of these changes were advanced. Both of these sub-tests showed significant differences between pre- and post-testing when the scores for both Phonetics and Voice and Diction students were combined. These results are of particular interest, in view of Seashore's contention that Tonal Memory is the only aspect measured by his tests which is capable of significant improvement.

Tests determining maintenance of rank ordering within the two student groups showed that both groups tended to change the least from pre- to post-testing for the measure of Tonal Memory. When the pre-post correlations of the two groups were compared it was found that the change in rank ordering of the two groups differed significantly on the Loudness and Time sub-tests. Reasons were posited for these apparent differences.

The data show positive and significant relationships between Transcription and each of the Seashore Measures. The individual sub-tests yielding the highest correlations account for only 23 percent of the variability. Accordingly, multiple correlation techniques were used to ascertain whether a better predictive tool could be achieved.

Intercorrelations of the pre-Seashore measures suggest that they are not completely independent measures, as maintained by Seashore. Likewise, intercorrelations of the Achievement Battery scores



suggest that these individual tests also have a great degree of overlap with each other. This high degree of overlap permitted the elimination of many sub-tests, simplifying the search for the best predictive grouping of tests.

The best two-variable multiple correlations involving Achievement sub-tests and those involving Seashore sub-tests differed very little from each other or from six-variable correlations involving all the Seashore sub-tests. Accordingly, the final prediction equation was based on two of the Seashore sub-tests--Time and Tonal Memory.

The resultant error of prediction is quite large, suggesting its ineffectiveness for individual predictive purposes. However, it is believed the formula can serve as a rough screening device to isolate the ends of the scale--i.e., predict the "poor" and the "excellent" transcribers. This would enable the phonetics instructor to immediately augment the amount of help given to the potentially "poor" student, and assist in the establishment of an accelerated enriched course for the potentially "superior" student.

It is suggested that future studies utilize this formula and take a closer look at the people isolated through its use. A comprehensive study of those people who would be "over-predicted" and those who would be "under-predicted" by this formula, should yield further insight into the basic problem of what traits or aptitudes are essential for phonetic transcription skill. Some of these variables could conceivably be age of the student, motivation, etc.

Cross-validation of this study is additionally recommended.

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