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AND HANDEDNESS FACTORS AT THE
SECONDARY SCHOOL LEVEL

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Bettye J. Myer, A.B., M.A.

****

The Ohio State University
1985

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The Ohio State University
To my mother,
Edna M. Campbell Myer

and

to the memory of my father,
Charles Myer
ACKNOWLEDGEMENTS

To express my appreciation to all those who have contributed to the completion of this dissertation is an awesome and humbling task. It is also a unique privilege.

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A final word of appreciation is due to Theresa Dispenza who typed the manuscript. Through her reassuring manner and professional skills, she permitted me to meet my deadlines, and to do so in a style that conformed to university guidelines.
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CHAPTER I

THE PROBLEM

Introduction to the Problem

In the mid-1980's "the pursuit of excellence in our schools" has become a battle-cry resounding throughout the United States; in faculty meetings, at conventions of professional educators, in the media, in the rhetoric of politicians, even on bumper stickers in New York state, a renewed concern for quality in education is being voiced. Central to the issue of excellence versus mediocrity in the public schools is the nature of the learner. As educators reconsider approaches to the teaching-learning process that will more effectively use the time allocated for instruction, answering the question "What are the characteristics of the learner?" is vital.

People differ. Each individual brings to a given situation a multitude of characteristics that comprise his or her unique potential for learning. Factors that have been identified as contributing to successful learning include age, sex, handedness, cognitive development, differences in learning style, personality, motor skills, auditory perception, visual perception, emotional development, prior learning, motivation, and aptitude. Having a measurement of any or all of these factors will permit a teacher to be more efficient in determining effective instructional materials and learning activities.
Diller's (1976) observation that "people look as different on the inside of their heads as on the outside" (p. 342) points up the complexity of the task that any teacher faces when confronted with a class. The complexity of the teaching-learning situation is perhaps greater in the foreign language classroom than in most academic settings. The task of the foreign language teacher encompasses the development of diverse language skills, including listening comprehension, speaking, reading, and writing. In addition to the development of language skills, the foreign language curriculum may include cultural goals that range from knowledge of nonverbal behaviors characteristic of speakers of the language to aspects of art, music, and literature. When the inherent complexity of the classroom language-learning situation is added to the natural differences in individual students, the real complexities of the teaching task become clearer. A teacher who treats each student as a unique individual who varies according to needs and strengths in a learning situation could benefit from access to as much information as possible about the learner's uniqueness.

Basing his conclusion on results of empirical studies, Chastain (1976) states that a strong case can be made for the "need to provide different types of learning materials and learning situations for different types of learners" (pp. 91-92). The recommendation made by Chronbach in 1957, urging researchers to design treatments to fit groups with particular aptitude patterns, thereby maximizing "their interaction with aptitude variables" (Boutwell & Barton, 1974, cited by Chastain, 1976, p. 212), could be implemented within the present
American education system. Technology at the end of the twentieth century is making it possible for teachers to realize more fully the dream of helping each individual achieve his or her potential in a learning situation. Individualized instruction, the "major educational movement of the early seventies" (Chastain, 1976, p. 199), combined with technological equipment (e.g., tape recorders, computer software), which allows students to develop selected skills, has the potential for significant advances towards effective "aptitude-treatment interactions," as advocated by Chronbach and Chastain.

Central to an individualized approach to learning is the assumption that almost anyone can learn anything if given the time needed to do so (Chastain, 1976). This premise stems from Carroll's definition of aptitude as "the 'amount of time' required by the learner to attain mastery in a given learning situation" (Chastain, 1976, p. 211). Fulfilling the requirement of this assumption, however, is not a sufficient condition to maximize a student's learning potential. In the individualized French option at The Ohio State University, students determine the amount of time to be spent on a topic by contracting for credit hours, in addition to deciding which goals they will emphasize through "variable goal options." At the present time, the individualized program does not provide for analysis of students' learner characteristics, such as aptitude or learning style, prior to their enrollment in individualized instruction; instead, the student's decision is a personal one that may or may not be in consultation with a professional. It is conceivable, however, that such information could be combined with
instructional procedures and materials appropriate to that student's potential to permit an individualized learner characteristics-treatment interaction.

This principle is in practice at the Annehurst Elementary School in Westerville, Ohio, where students are assessed regularly by their teachers on ten learner characteristics that include verbal experience, intelligence, auditory perception, motivation, emotional maturity, personality, visual perception, creativity, social maturity, and motor perception (Frymier, 1977). The children, in consultation with the teacher, establish individual goals on a weekly basis. They access materials through a system that identifies materials categorized by the traits evaluated, assuming considerable responsibility for their own learning. This capacity to analyze learner characteristics and to match students to a methodology and materials that maximize the learner's talents is opening new horizons.

Canadian foreign language educators are among those who are evaluating student characteristics in order to adapt materials and methods to the individual strengths and weaknesses of the learner. Adults learning French in the Public Service language training program are first evaluated on language aptitude factors, personal characteristics, and previous achievement; subsequently, they are instructed according to one of three methodological approaches (Wesche, 1981). Experienced guidance counselors are able "to predict failure to meet the required French standards with an accuracy of 85-90 percent" by taking into account knowledge of subtest scores on the Modern Language Aptitude Test (MLAT) (Carroll & Sapon, 1959) and the Pimsleur
Language Aptitude Battery (PLAB) (Pimsleur, 1966). The ability to predict the degree of a learner's success in a given learning situation can contribute to more efficient use of the learner's and instructor's time. In a foreign language learning situation, where diverse language skills are involved, it would be expedient to know if different aptitudes contribute to the development of different foreign language skills, and which aptitude relates to which skill.

The work of Walsh and Diller (1978) provides insights into how neuroscientific knowledge about the structure and function of the cerebral cortex relates to methodologies of teaching a second language. They describe the function of Broca's and Wernicke's areas, the two regions of the brain considered to be language centers, then explain the probable involvement of these areas when different methods of foreign language teaching are used. It is clear that different teaching strategies require involvement of very different neural pathways. Although there is an accumulating body of research on cerebral functioning in the area of language learning, much still remains a mystery. This is especially true in the area of auditory perception (Walsh & Diller, 1978, p. 5).

Listening Comprehension and Speech Perception

There seems to be general agreement on the importance of listening as a skill to be developed in most foreign language classrooms. The "least understood of the four skills and consequently the least well taught" (Pimsleur, et al., 1977, p. 2, cited in Mueller, 1978), listening encompasses both speech perception and listening comprehension.
Some researchers have suggested that a special listening comprehension factor exists, but it has not yet been fully characterized (Rivers, 1975). Listening comprehension, according to Andre (1974), takes place "when the listener consciously and actively operate(s) on the speech input at the meaning level," whereas, speech perception precedes the comprehension level as "the first step in listening comprehension, . . . the initial registering of spoken language" (p. 7). Both terms are of interest to the present study. This investigation will consider relationships among factors that are thought to correlate with achievement in foreign language auditory skills, both at the perception and comprehension levels.

Statement of the Problem

In an attempt to isolate variables that, individually or in combination with other factors, correlate with success in auditory foreign language achievement, the present investigation examined relationships among measures of prior academic achievement, foreign language aptitude, musical aptitude, prior musical experience, and personal attribute factors of sex, age, and handedness. The following general questions were posed: Is musical aptitude a positive correlate with success in auditory foreign language achievement? Does auditory foreign language aptitude correlate positively with auditory musical aptitude or musical experience? Is learner performance in the auditory discrimination of syllables and stressed syllables significantly related to other factors, such as auditory musical aptitude and foreign language auditory aptitude? Is individual
performance on achievement and aptitude measures significantly related to the handedness preference or sex of the individual? It was these general questions that served as the basis for the research of this study.

Significance of the Problem

The present study investigated variables relating to a foreign language skill that recently has been identified at the state and national level as one in need of development in the curriculum. In proposing a national program to raise Americans' competence in foreign languages, the Presidential Commission on Foreign Languages and International Studies underlined the necessity for foreign language instruction that concentrates on listening and speaking skills in its report to President Carter in 1979. The impact of this statement is being felt throughout the nation. In 1984 the Board of Regents of the State of New York passed the proposed "Action Plan to Improve Elementary and Secondary Results in the State of New York"; this plan specifies that listening and speaking skills be stressed in preparing for the proficiency exam that will become mandatory in 1988 for all New York State students prior to the end of grade nine. Following the 1983 national convention of the American Council of Teachers of Foreign Languages, a symposium was held in Monterey, California to lay the groundwork for the development of procedures and instruments for testing listening comprehension proficiency.

Quinn and Wheeler (1975) described listening comprehension "as an extremely important skill badly in need of re-emphasis in the
curriculum" (p. 2; cited in Mueller, 1979, p. 5). It is estimated that most foreign language learners will spend more time in listening to the language in question than in speaking it (Littlewood, 1981). Because the present study examined skills that contribute to auditory perception and listening comprehension, it addressed this area of interest. Relationships between measures of auditory discrimination in foreign languages, measures of musical aptitude, and measures of academic achievement in areas other than foreign languages were primary in the investigation.

Conducted with students ranging in age from 11 to 15, the present study provides information about an age group that researchers in foreign language education have seldom examined. Knowledge about learners in the junior high school years is of interest to those who would like to develop foreign language study in the elementary schools and continue instruction over a long period of time, an objective advocated by the Presidential Commission and the New York Board of Regents.

**Purpose of the Study**

This study investigated relationships among sets of musical aptitude measures, sets of language aptitude measures, selected measures of foreign language and general achievement, prior musical experience, and selected personal attributes. The following research questions were addressed:

1. What is the direction and strength of correlational relationships among selected measures of musical aptitude, foreign language aptitude, foreign language
auditory achievement and prior achievement in other curriculum content areas?

2. Do the personal attributes of sex and handedness significantly relate to performance on measures of auditory language perception and listening?

3. What is the direction and strength of relationships among measures of syllable discrimination ability, syllable stress, measures of auditory foreign language aptitude and measures of foreign language achievement?

It was the primary purpose of this study to investigate relationships among selected measures of musical aptitude, foreign language aptitude, musical experience, prior academic achievement in areas other than foreign language, personal attribute factors that are considered correlates of foreign language achievement (sex and handedness), and measures of foreign language achievement. More precisely, the measures of foreign language aptitude and of foreign language achievement evaluate aspects of auditory comprehension, either in isolation or in combination with another language skill. This investigation attempted to determine correlates of the auditory skills involved in language learning; therefore, any information gained from the study will contribute to an understanding of skills related to auditory aspects of foreign language aptitude and achievement, either in isolation or in combination with other skills.

Completed in two phases, this investigation addressed research questions that are correlative and predictive in nature. In Phase I
the following questions relating to auditory foreign language aptitude were investigated:

I-1. Are there significant first-order correlational relationships among measures of musical aptitude and musical experience, foreign language aptitude, auditory syllable discrimination, and prior academic achievement?

I-2. Which measure or sets of measures of aptitude and prior achievement variables are significantly related to which measure or set of measures of auditory foreign language perception?

I-3. Are the variables under investigation significantly related to the categorical variables of sex and handedness?

In Phase II, auditory foreign language achievement variables were examined, in addition to those variables included in Phase I. Four primary research questions were investigated:

II-1. Are there significant first-order correlational relationships among measures of auditory foreign language aptitude, musical aptitude and experience, auditory syllable discrimination, prior academic achievement, and foreign language achievement?

II-2. Are there significant canonical correlations among the set of measures of auditory foreign language aptitude, auditory syllable discrimination, musical aptitude and experience
II-3. Are the categorical variables of sex and handedness significantly related to the measures of foreign language achievement?

Operational Definitions

Aptitude, academic achievement, auditory syllable discrimination, personal demographic factors, and musical experience were measured for this study according to the following operational definitions.

Auditory Foreign Language Aptitude was defined as the abilities measured by the two auditory subtests of the Pimsleur Language Aptitude Battery (PLAB) (Pimsleur, 1966). Three scores were utilized:

- PLAB 5: Sound Discrimination.
- PLAB Auditory Total (a + b).

Auditory Foreign Language Achievement was defined in terms of student response on a 64-item test in German, French or Spanish. Equivalent forms of a test covering basic vocabulary and grammar studied in first-year foreign language classes in the school district where the main study was conducted were developed by the researcher in cooperation with the classroom teachers.
The test was divided into four parts: Part I A and B, Listening Comprehension; Part II, Sound/Symbol Association; Part III, Dictation; Part IV, Oral Questions/Written Personal Answers. Two scores were analyzed:

a. Auditory Total: Part I (Section A—Oral Multiple Choice with Drawing and Section B—Oral Question with Oral Multiple Choice Answers) + Part II (Sound/Symbol Association) + Part III (Dictation).

b. Part IV (Oral Question/Written Personal Answer).

Musical Aptitude was defined in terms of subject performance on selected subtests of the Gordon Musical Aptitude Profile (MAP) (Gordon, 1965a). Six scores were analyzed:

a. Tonal Imagery-Melody.
b. Rhythm Imagery-Tempo.
c. Rhythm Imagery-Meter.
* Rhythm Imagery-Total (b.+ c.).
d. Sensitivity-Phrasing.
** MAP Composite (a.+ b.+ c.+ d.).

Auditory Syllable Discrimination was measured by two subtests of the Syllable Discrimination Test (SDT), an instrument developed by the researcher. Two scores were used:

a. Number of Syllables.
b. Accented Syllable.
Prior Academic Achievement is defined by twelve scores obtained from school records for student performance on the Iowa Tests of Basic Skills. These included:

a. Vocabulary.
b. Reading.
c. Language Skills-Spelling.
d. Language Skills-Usage.
* Language Skills-Total.
g. Work Study Skills Total.
h. Mathematics Skills-Concepts.
i. Mathematics Skills-Problems.
* Mathematics Skills-Total.
** Iowa Composite (a. + b. + c. + d. + f. + g. + h. + i.)

Handedness was defined in terms of student responses to five questions (Annett, 1970) posed in item #7 of the Personal Background Questionnaire (PBQ). Students were categorized as (1) right-handed, (2) left-handed, (3) ambidextrous-right, (4) ambidextrous-left, or (5) ambidextrous. For Phase I analyses (n = 133), the three ambidextrous categories were treated as one category resulting in (1) right, (2) left, and (3) ambidextrous. In Phase II due to the small number of subjects (n = 54), only two categories were defined. These were (1) right, and (2) left, ambidextrous-right, ambidextrous-left, and ambidextrous.
Musical Experience was determined by student response to item #8 on the PBQ, a report of years of student participation in private or scholastic musical performance.

Native Language was the language designated by the student in item #5 of the PBQ as the one that they learned to speak first.

Age was the age of the student, rounded to the nearest whole number, at the time of completion of item #3 on the PBQ.

Sex was reported by the students in item #2 of the PBQ.

Prior Foreign Language Experience was reported by students in item #6 of the PBQ.

Assumptions

Research involving foreign language aptitude is based on certain theoretical assumptions. It assumes that abilities or talents that contribute to language learning do exist, and secondly, that they are evenly distributed in the population and can therefore be quantitatively measured (Valette, 1977). In addition, it is assumed that "the nature of 'aptitude' can vary as instructional objectives change" (p. 304).

In this study, it was assumed that the instruments used do in fact measure the constructs their developers purport to measure. It was further assumed that the students involved in the study performed
to the best of their abilities on the tests and provided accurate personal information on the Personal Background Questionnaire.

**Limitations of the Study**

Because of the *ex post facto* nature of the study, causal inferences cannot be drawn. The interpretation of the results is restricted because random selection of subjects was not possible.

This study is limited in generalizability to the population in which it was conducted, i.e., students enrolled in beginning foreign language classes at a small-town unified school district located in a middle-class community of predominantly European extraction.

The results of this investigation are further limited by the voluntary exclusion of variables that may indeed contribute additional information pertinent to the research questions, such as intelligence (Parry, 1984), grade point average (Kangas & Kellogg, 1965), foreign language aptitude measures in addition to auditory ones, measures of creativity (Cox, 1981), and measures of personality and attitude (Bush, 1983). A measure of intelligence was not included in the present study because previous research that correlated foreign language achievement found that among the factors IQ, GPA and language aptitude tests, IQ seems to have the least correlation with achievement (Kangas & Kellogg, 1965; Pimsleur, Stockwell & Comrey, 1962). Because there was no grade-point average available for students at the end of grade seven, at the time of administration of
the Phase I tests, academic achievement was measured by student performance on subtests and total scores of the Iowa Test of Basic Skills.

Organization of the Dissertation

This research report is divided into five parts, followed by references and appendices. In Chapter I the problem under investigation has been introduced and terms have been defined. Chapter II reviews relevant research, including theoretical and methodological concerns. Chapter III describes in detail the procedures to be used in the study, including reports of pilot studies and instrument development. In Chapter IV the statistical analyses of the data collected in Phases I and II of the main study are presented, and findings are discussed. Chapter V provides a summary of the study and an interpretation of the data, concluding with a discussion of limitations, implications, and recommendations for further research.
CHAPTER II

REVIEW OF THE LITERATURE

Introduction

From neurolinguistics, psycholinguistics, and the behavioral sciences research continues to supply evidence that all of human learning and behavior depends upon complex, integrated, neurological functioning that varies in cerebral organization among so-called normal learners as well as those evaluated as learning disabled. In this review of literature pertinent to the present investigation, theoretical and empirical research will be presented in an attempt to elucidate factors believed to be related to performance in auditory foreign language achievement.

The chapter is organized into two broad sections. Section one examines theoretical and empirical research on the topic of auditory perception of speech and music. Subtopics include the role of rhythm as an organizer of speech and music, the syllable as a unit of auditory discrimination, the nature of the syllable, and the role of stress in the perception of language. Section two reviews theoretical and empirical literature relating to selected factors that may contribute to foreign language achievement. Topics discussed in this section are: the nature of aptitude, including subtopics on foreign language aptitude and musical aptitude; research relating foreign language aptitude to foreign language achievement; sex; and handedness.
Rhythm as an Organizer of Speech Perception

From psychology, theories concerning an understanding of the perception of auditory patterns are emerging that provide a theoretical foundation for this present investigation. As early as 1967, Neisser (1967) proposed that language is an active, constructive process. He theorized that a "rhythmic pattern is a structure" (p. 235), "a single structural unit" (p. 233), which serves to support and integrate a series of words to be remembered. Neisser bases his theory, in part, on evidence that subjects in memory-span experiments nearly always impose their own rhythmic organization on the strings of digits they are to remember (e.g., a telephone number). One hypothesis is that the active verbal memory that underlies such performances cannot exist at all except as an organized structure and that rhythm is the simplest form of organization available to subjects.

Concerning the perception of auditory patterns, Jones (1976) states: "There are many questions—one of these has to do with the way people perceive structure in time, that is rhythm. To date, we have no satisfactory answer to this question which is at the heart of both speech and music perception" (p. 19). Real speech, like music, combines sounds into rapidly changing patterns that are rhythmically organized (Martin, 1972; cited in Jones, 1976). Jones (1979, p. 6) argues that people are fundamentally rhythmical, relating to time (rhythm) patterns, not by passively receiving the events one at a
time, but by synchronizing their internal rhythms to the various levels of time in the incoming sequence. This synchrony facilitates anticipation of future auditory events. In proposing a definition of expectancy, which can be applied to speech as well as music, Jones (p. 5) has developed a pitch/time hierarchy to represent the determinants of expectancy. It encompasses tempo, rhythm, and pitch, three elements that are characteristic of both speech and music. The combined hierarchy allows her to explain a person's "dynamic expectancy" as a function of velocity-like properties of the perceived auditory pattern. Specifically, expectancy is a function of the pitch distance at some hierarchic level over the time span at that level. Although the following discussion concerns the perception of music, the theory Jones (1979) proposes contributes to an understanding of speech perception:

On the basis of spatio (pitch) and temporal (rhythm) invariants in the incoming sequence we anticipate the "where" (in pitch space) and the "when" (in time of future events. And this anticipation activity, I believe, is an important part of explaining why some melodies, and some combinations of melodies, rhythm and tempo are easy and others are not so (p. 8).

Jones has proposed that the structure of an auditory sequence depends upon related dimensions, including the time dimension, and that a listener synchronizes internal rhythms in anticipation of future auditory events. The implications of this theory of expectancy are of interest to those concerned with the auditory perception of a foreign language.

In all of this, our goal has been to be able to show that as a person becomes more sophisticated and skilled at listening, his or her expectancies change to incorporate
originally unanticipated events. When this happens, we argue that a listener's own rhythmic structure has become meshed or synchronized with temporal elements within the music. And this synchrony is an intrinsic part of understanding the full structure of a piece of music (Jones, 1979, p. 8).

As language students become more sophisticated and skilled at listening, they incorporate "originally unanticipated events." As a listener's rhythmic structure becomes meshed with the temporal elements of speech in a foreign language, he or she perceives the word boundaries and the structure of the language more fully.

Jones (1978) suggests that the structure of an auditory sequence is "carved from several related dimensions, including the time dimension" (p. 284) and that a listener actively synchronizes internal rhythms in anticipation of future auditory events. The implications of this theory of expectancy are of special interest to those concerned with the auditory perception of a foreign language.

The Syllable as a Unit of Auditory Perception

The syllable is a cognitive unit central to an understanding of speech perception, including both the perception of native or foreign languages (Chreist, 1964). According to Neisser (1967), there are "short segments, of syllabic size or smaller, that function in normal speech perception" (p. 187). That is not to say that syllables are the only unit of speech perception; rhythmic groups and corresponding grammatical segments are also units of processing.

In short, there seems to be no unit of fixed size on which speech perception depends. The scale of the segment which is recognized or constructed varies at least from the syllable to the phrase, with a flexibility comparable to that found in vision (Neisser, p. 189).
Another factor related to the perception of speech and of syllables is the perception of word boundaries, the separation of the flow of auditory stimuli into words. Neisser points out that word separations are not "given in the stimulus, but supplied by the listener. It is partly because we cannot carry out this construction in an unfamiliar language that foreigners seem to talk so fast" (p. 189). This difficulty experienced in the auditory perception of word boundaries is explained by Jones' theory of expectancy discussed above. As a foreign language learner becomes skilled in anticipating the flow of speech of the new language, increasingly synchronizing his or her internal expectancies with the perceived speech, the word boundaries become increasingly evident. Indeed, most language learners utilizing tape-recorded materials experience the phenomenon of having the tapes seem slower as they become more comprehensible.

The definition of a syllable varies from language to language. Not only does this contribute to difficulty for learners in the perception of auditory syllables, but it complicates the distinction of word boundaries for the listener. Chreist (1964) defines the American English syllable as "a unit of spoken language consisting of a vowel [u], a diphthong [a], or a syllabic consonant [!] as in cattle [Katl], alone or in combination with one or more consonants preceding or following in the sound group" (p. 58). In French, however, every syllable contains one and only one vowel sound that is articulated with much less diphthongization than the English vowel (Gottfried, 1984). French syllables tend to begin with a consonant sound and to end with a vowel, a characteristic referred to as "open
syllabication"; it has been estimated that in spoken French nearly 80% of the syllables are composed of a consonant-vowel (CV) structure (Leon, 1966). This fundamental rule is applied across the boundaries of words (Bernac, 1970). The following sentence illustrates the tendency for a consonant between two vowels to link to the following vowel and form a syllable with it:

Il est seul avec un enfant (Guex & Pithon, 1975, p. 12).

\[ i \text{ le so\text{ö} la ve K\text{ä} n\text{ä} f\text{ä} } \]

In contrast to the French syllable, the English syllable tends to end in a consonant sound (Delattre, 1962). Approximately 44% of English syllables end in a vowel sound (Dauer, 1983).

French syllables tend to be of equal length, with the exception of the final syllable of a thought group, which is approximately twice as long and is thus stressed (Delattre, 1949, 1951; Bernac, 1970; Guex & Pithon, 1975). At times, French syllables are completely eliminated as in the elision of the "e muet" (Dauer, 1983). The length of an English syllable depends on whether or not it is stressed; a stressed syllable lasts longer than an unstressed syllable. Vowel reduction and the tendency toward the English schwa [ə] in unstressed syllables contribute to a pattern of speech vastly different from the regular pattern of French. Instead of dropping syllables, English tends toward the maintenance of syllables but allows for variation in vowel length to accommodate the rhythm of the sentence. Stressed English syllables are on the average between 200-350 milliseconds (ms), unstressed ones are less than 100 ms (M. Jones, personal communication).
of class notes, Autumn, 1978). Vowel reduction in English is a
"phenomenon of great generality" (Stockwell & Bowen, 1965, p. 102).

Japanese, like French, has been described as a syllabic language,
meaning that syllables tend to be equal length (Jolly, 1975; Jorden,
1963), resulting in a rhythm that is regular and even. The syllable
in Japanese is defined in such a way that every vowel receives a full
syllabic beat rather than being lengthened or shortened as English
syllables are. When two vowels occur together in Japanese, each
receives a full syllabic beat. Japanese also has one syllabic
consonant [n] that always has a full syllabic beat of its own; it is
pronounced through the nose with the length of a full syllable and
perceived by the Japanese listener as a full syllable. In addition,
four other consonants [k s t p] occur as syllables by themselves
depending upon their location before a syllable that commences with
the same consonant (Jorden, 1963).

The tendency toward equal syllabic length characterizes the
Romance languages and Japanese (Chreist, 1964). Because English
syllables vary in length, depending upon the stressed or unstressed
nature of the syllable, the expectancy of the English-speaking
listener learning a foreign language is for a similar pattern of
stressed syllables. The transfer of stress-pattern tendencies from
the native tongue to a foreign language being learned is readily
observable in the oral production of another language by many speakers
of English and likewise in the speech of foreign speakers of English.
Language Rhythm and Syllabic Stress

The rhythm characteristic of a language is revealed in the relationships of stressed and unstressed syllables with each other and with periods of silence (Chreist, 1964, p. 56). English is a stress-timed language (Bolinger, 1965; Dauer, 1983; Miller, 1984; Vrtunski, 1976); that is, major stresses occur at approximately equal intervals in a sample of continuous speech. Other stressed-timed languages include Arabic, Russian, the Germanic languages, conversational Thai, and Brazilian Portuguese. (Dauer [1983, p. 56] summarizes research relating to syllable-timed and stressed-timed languages.) This fundamental difference in rhythm is an important key to understanding foreign language speech patterns for speakers of English.

French, Spanish, and Japanese have been labeled syllable-timed, i.e., there is approximately equal distance between each syllable, and English and German are called stressed-timed (Dauer, 1983). Although the terms are commonly used, Dauer indicates that speakers of the syllable-timed languages are not necessarily in agreement with the categorization. For example, Japanese has been perhaps more accurately described as a mora-counting syllable language (McCawley, 1968). The mora is the traditional Japanese unit of length in the language consisting of either a consonant plus vowel, a vowel alone, a mora nasal, or mora obstruent. McCawley (1968), in discussing the reasons "why the notion of mora is essential to a description of Japanese" (p. 133), explains that Japanese has phonological rules dependent upon the number of moras:
For example, in a certain class of foreign loan words the accent is put three moras from the end of the word. The mora is thus the "unit of phonological distance" in Japanese, so that . . . Japanese is a mora-counting language. However, it will be recalled the fact that a language is mora-counting does not imply that it is also a "mora-language": there are "mora-counting mora languages" (such as Classical Greek) and "mora-counting syllable languages" (such as Classical Latin), a language being one or the other depending on whether its "prosodic unit" is the syllable or the mora. It can easily be seen that the prosodic unit of Japanese is the syllable and not the mora. . . . Japanese is thus a mora-counting syllable language (pp. 133-134).

The nature of stress is not identical in all languages. Stress may be expressed through intensity, loudness, duration, pitch, and/or vowel color. German, French, Spanish, and Japanese all have characteristics that contrast with American English in the ways the syllabic stress functions. The following discussion is intended to provide some introductory ideas about the nature of stress in these languages.

According to Dauer (1983), most stress-timed languages have lexical or word level stress that make stressed syllables more prominent than unstressed syllables. Delattre (1965) compared the position of primary word stress in words of one, two, three or four syllables in German, English, French, and Spanish by analyzing texts of five to eight pages in each language (see Figure 1). His analysis revealed that English had "the greatest variability in stress position" (p. 29); German was less varied than English, but still showed "considerable variability of position" (pp. 29-30); Spanish showed a "definite tendency for fixed stress position" (p. 30); and French had "a completely fixed place of stress" (p. 30).
Thus, a comparison of the four languages reveals a clear progression: freedom of stress position is greatest in English; it is somewhat less in German; a tendency toward a fixed position appears in Spanish; and a completely fixed position is reached in French (Delattre, 1965, p. 30).

Although the German stress pattern resembles that of English, the rules for stress in words, which are carefully defined in German, are less easily defined in American English. Indeed, learning the stress
pattern of English is extremely difficult for those who are not native speakers for just that reason. In addition, stress is phonemic in English, distinguishing meaning merely through a change of syllabic stress (e.g., `advocate` as a noun [\textipa{a\textipa{d}ˈ\textipa{v}\textipa{\textipa{\v}}\textipa{k}\textipa{\textipa{\textipa{i}}\textipa{\textipa{t}}}] ; `advocate` as a verb [\textipa{a\textipa{d}ˈ\textipa{v}\textipa{\textipa{\v}}\textipa{k}\textipa{s}\textipa{t}ˈ]).

Spanish has two degrees of word stress, strong and weak. English has three degrees of stress: strong, weak and medial. In Spanish the most common syllabic structure is CV (58%). This is also true of the corresponding English syllabic structure (CV=34%), followed by the second most frequent English syllabic structure of CVC (30%). In Spanish, however, CV structure is common regardless of the stressed (53%) or unstressed (61%) nature of the syllable; whereas, English CV syllables tend to occur in unstressed position (38%), with only 28% of stressed syllables composed of a CV structure. The most common syllabic structure in stressed position in English is CVC (35%) (Dauer, 1983, pp. 57-58). These findings are in general agreement with Delattre (1962).

French, in contrast with English, has no word stress pattern that is phonemic in character, although a stress of duration characteristically occurs at the end of each thought group or rhythmic group. The accent d'insistance, emotive stress, does occur with more or less frequency, depending upon the speaker.

Delattre (1965) has described the placement of emphatic stress, as compared to logical stress, in French as a shift to an earlier syllable in a word.
Special emphasis on a word tends to shift the stress toward the beginning of the word if it is not there already. This is a regular process in French where *impossibilité* becomes *IMpossibilité* or *imPOssibilité* in emphatic stress, depending on how emotive the reason for emphasis is (p. 34). [Underlining replaces italics in original version.]

Such a change in the syllable being stressed in order to express emphasis does exist in English, German, and Spanish; "habitually, however, English, German, and Spanish, unlike French, keep emphatic stress on the same syllable as logical stress" (p. 34).

Stress in Japanese is expressed by a change of pitch contour, rather than a stress of intensity or loudness. The last high-pitched mora is the accented mora. The moras following the accented mora are all low-pitched. McCawley (1968) describes the accented syllable in Japanese as the one which contains the accented mora.

The accented mora is characterized solely by its high pitch relative to the following mora; it does not differ in length or intensity from other moras. . . . In Japanese the information which the pitch gives about each syllable is merely the answer to the question "Is this the accented syllable?", a question to which the answer is either yes or no and for which the answer will be no for all but one of the syllables. . . . Thus, pitch in Japanese expresses merely a location (p. 135).

Although the exact timing relationships among syllables and stressed syllables is still being debated, Dauer (1983) concludes that it is possible to say that a language is more or less stress-based, depending on how large a role stress plays in that language. Languages can be compared according to their degree of stress-based rhythm, ranging from Japanese at one end of a continuum (less stress-based), to French to Spanish to Greek to Portuguese to English
(stress-based) (p. 60). It has been proposed that regularity in rhythmic grouping is a language universal (Martin, 1972, in Dauer, 1983); Dauer suggests that the "differences summed up by 'stressed-timed' and 'syllable-timed' refer to what goes on within rhythmic groups, the characteristics of successive syllables and their interrelationships, which are ultimately a product of the entire linguistic system" (1983, p. 60).

For a speaker of American English, listening with American English expectancies, initially the auditory perception of foreign languages is influenced by the American English mental set for syllables, word boundaries, stress pattern, and rhythm, all of which are intricately intertwined. There is no doubt in the minds of teachers of foreign language that the ability to perceive sounds, words, and phrases, and, subsequently, to extract meaning from speech in a foreign language is not a skill developed to the same degree in every student.

**Selected Factors Affecting Achievement**

**Aptitude**

The notion of aptitude, "the student's facility or capacity for learning in any given area" (Chastain, 1976, p. 211), is not new. In 1575, the concept of aptitude, including "intimations of a concept of foreign language aptitude," appeared in a work entitled *Examen de Ingenios* (Examination of Aptitudes for the Sciences) by a Spanish physician, Juan Huarte (Carroll, 1981, p. 87). It was not until the twentieth century, however, that the development of instruments for measuring aptitude permitted formalized testing of this construct.
Although psychologists and educators continue to debate the existence of aptitude as a construct distinct from achievement (Carroll, 1981; Gordon, 1965a), numerous tests of aptitude do exist, following Binet's general scheme, derived at the beginning of this century, for the measurement of intelligence (Popham, 1975, p. 90).

**Foreign Language Aptitude**

The question of whether foreign language aptitude exists has been carefully pursued by Carroll for over 25 years. Carroll (1981), in his summary of research on foreign language aptitude, concludes that a "knack" for learning foreign languages does exist as an ability distinguishable from intelligence and verbal intelligence (1981, p. 86). Carroll maintains that "foreign language aptitude is relatively fixed over long periods of an individual's life span, and relatively hard to modify in any significant way" (1981, p. 86).

In response to the question "What, then, is language aptitude?" Diller (1978, p. 125) has responded: "To put language learning aptitude in its place, we should say that it is a set of cognitive abilities (based on neural structures and pathways) that are for language learning" (1978, p. 125). As researchers learn more about cerebral processing, an understanding of aptitude will undoubtedly include evidence of the neural pathways participating in language learning. At the present time, however, "we are cavemen" in our knowledge of how the brain functions according to Gevins of the San Francisco Brain Laboratory (Cognitive Science and Educational Practice Conference at The Ohio State University, July 7-9, 1982). Therefore,
to approach the concept of aptitude, it seems logical to summarize theoretical and empirical evidence relating to language learning in terms of components that have been shown to correlate with success in foreign language learning in traditional educational settings, and to provide a framework for language learning aptitude from current research results in cerebral functioning.

The monumental work of Carroll and, subsequently, of Pimsleur in the development of aptitude batteries resulted in the three commercial foreign language aptitude tests currently available: the Modern Language Aptitude Test (MLAT) (Carroll, 1959), including a long and a short form; the Modern Language Aptitude Test—Elementary (EMLAT) (Carroll & Sapon, 1967); and the Pimsleur Language Aptitude Battery (PLAB) (Pimsleur, 1966). Of the three, the PLAB is appropriate to junior high school as well as older students (grades 6-12). Pimsleur acknowledged his debt to the MLAT, and considered the MLAT and PLAB to be approximately of equal validity (Pimsleur, 1966, cited in Carroll, 1981).

Both Pimsleur and Carroll distinguished components of foreign language aptitude that are strikingly similar; in Carroll's terms, they include: phonetic coding ability, grammatical sensitivity, rote-learning ability, and inductive language learning ability. Phonetic coding ability, defined by Carroll as "the ability to identify distinct sounds, to form associations between those sounds and symbols representing them, and to retain these associations" is the auditory aptitude component of greatest interest to auditory perception or auditory comprehension. It is represented in the MLAT-2 (Phonetic
Script) and in the PLAB-5 (Sound Discrimination) and PLAB-6 (Sound-Symbol Association) (Carroll, 1981, pp. 105-106). It is this component of foreign language aptitude that is of interest to the present investigation.

One useful area of study to comprehend auditory foreign language aptitude is that of the relationship between the ability to learn a foreign language and an aptitude that also depends on auditory ability--musical aptitude. Pioneer research in musical aptitude by Seashore (1919) led to the first musical aptitude battery, which permitted the examination of correlates of musical aptitude.

Musical Aptitude as a Correlate of Foreign Language Aptitude

During the past 50 years several researchers have examined relationships between musical aptitude and the ability to learn a foreign language. A few studies have reported positive correlations between measures of musical aptitude and measures of foreign language achievement (Arellano & Draper, 1970; Arendt, 1967; Coulthard, 1952, reported in Shuter, 1968; Dexter, 1934; Dexter & Omwake, 1934; Eterno, 1961; Leutenegger & Mueller, 1964; Pimsleur, 1962; Pimsleur, 1963). In a discussion of foreign language aptitude, Valette (1977) concluded, however, that there was insufficient evidence to support the position that musical aptitude is related to foreign language ability.

Some teachers feel that musical ability is somehow related to language aptitude. There does not seem to be a definite measurable correlation, although research has indicated that perhaps the ability to discriminate pitch may be a factor in language aptitude (p. 305).
In discussing the speculation "that musical ability is a correlate of foreign language aptitude," Carroll (1981) states that "there is as yet no convincing evidence to establish this correlation on a firm basis" (p. 95). He clearly indicates, however, that additional research is recommended in order to establish more firmly the extent and nature of the relationship between "aspects of foreign language learning success and whatever is measured by musical auditory ability tests" (p. 96).

A review of studies dealing with musical talents and foreign language abilities by Blickenstaff (1963) has influenced both Valette and Carroll's positions. Blickenstaff concluded that studies were "too few and contradictory to warrant any sweeping generalizations" (p. 362). In the same document, however, Blickenstaff also stated that two Pimsleur investigations done in 1962 "offered substantial evidence that pitch discrimination is related consistently and rather independently to the auditory comprehension of French and probably Spanish as well (p. 362). He also remarked that timbre discrimination "appears to bear some relationship to the auditory comprehension of French" (p. 362).

Subsequent to the Blickenstaff review, researchers have reported evidence of significant positive relationships between subtests of the Seashore Measures of Musical Talents (Seashore, Lewis & Saetveit, 1956) and foreign language achievement in subjects at university, secondary, and elementary school levels. The Seashore Tonal Memory subtest was a significant factor in predicting success in foreign language learning at the university level (Leutenegger, Mueller &
Wershow, 1965) and at the high school level (Arendt, 1968). Arendt found that the Seashore Loudness Test contributed significantly to the prediction of German reading and writing ability and results on the Modern Language Cooperative Test. In the same study, the Seashore Timbre subtest contributed to the multiple correlation with measures of French reading and writing and the German foreign language grade.

In an investigation involving elementary school students, Arellano and Draper (1970) found a positive relationship between musical aptitude (including discriminatory musical abilities of pitch, intensity, rhythm, timbre, and tonal memory as measured by the Seashore battery) and Spanish accent achievement, "even when their common relationship with I.Q. is taken into consideration" (p. 114). The Arellano and Draper study did not find significant correlations with a test of Spanish listening comprehension (Carroll, 1981, p. 95). An examination of the listening comprehension test used in the Arellano and Draper study reveals that the answer for each of the questions is apparent in the item stem; recognition of an identical word or a vocabulary term in the same category is sufficient to determine the correct answer in each instance, reducing the processing of meaning to a minimum. In spite of the flaws in the listening comprehension measure, the overall strength of the study is powerful evidence for a positive relationship between musical aptitude and Spanish accent achievement.

Looking at the question from the viewpoint of a music researcher, Shuter (1968) reviewed studies that related musical ability to various other abilities; only oral French showed a "marked correlation with
musical ability" (p. 232). Citing the results of Coulthard's (1952) study with high school students tested extensively on aspects of French pronunciation, accent, intonation, phrasing, and fluency, Shuter stated that the coefficients of .53 (Wing Test of Musical Achievement 1-7) and .42 (Wing Test of Musical Achievement 1-3) were the highest correlations reported at that time. Although positive correlations between measures of musical ability and other cognitive aptitudes were cited, except in the case of oral French, the coefficients were low. In a recent revision of The Psychology of Musical Ability (Shuter-Dyson & Gabriel, 1981), the results of Coulthard's study are described as showing a "moderate" rather than a "marked" correlation between oral French and musical ability. Whether the correlation is moderate or marked, the Coulthard results support "the popular view that musical children have an advantage when it comes to learning to speak a foreign language" (Shuter, 1968; Shuter-Dyson & Gabriel, 1981).

The research that has examined relationships between musical aptitude and foreign language achievement is diverse in method and level, having been conducted with university, high school, and elementary school subjects. Measures of various musical abilities (pitch, timbre, tonal memory, loudness, intensity, and rhythm) have been found to correlate positively with diverse aspects of foreign language achievement. The Seashore Measures of Musical Talents (SMMT) have most frequently been used to assess musical aptitude with the exception of the Coulthard study (1952), which used the Wing instrument. Carroll observes that researchers have restricted the selection of musical aptitude measures to the Seashore battery,
though more recent instruments are available (Carroll, 1981, p. 96). The Seashore test is frequently described as atomistic due to the nature of the skills evaluated by the subtests: loudness, pitch, rhythm, timbre, time, tonal memory. One excellent alternative is the Gordon Musical Aptitude Profile (MAP) (Gordon, 1965), a battery designed to test integrated skills of musicality to a greater degree than the Seashore instrument. Described as the best available musical aptitude battery, the major drawback of the MAP is the length of time needed for administering it in its totality (Shuter-Dyson & Gabriel, p. 28).

Musical Aptitude

One of the first attempts to define musical ability or talent appeared in 1894 in "Wer ist musikalisch?", a publication by a Viennese surgeon named Billroth (Henson, 1977). It was in the twentieth century, however, that Seashore published the first test of musical aptitude, the Seashore Measures of Musical Talent (1919), after twenty years of intensive experimental work. Seashore believed that musical ability was an innate capacity composed of separate but related areas involving sensory discrimination (Radocy & Boyle, 1979, p. 264). The five capacities measured in the original test battery were sense of pitch, intensity discrimination, sense of time, sense of consonance, and tonal memory. A sixth test, sense of rhythm, was added in 1925 (George, 1980). The test stimuli were created on laboratory instruments—a tuning fork and a beat-frequency oscillator. It is probable that musical instruments were not used to avoid
contaminating the test with factors "indigenous to a particular culture" (Gordon, 1971a, p. 12).

After an additional 20 years of research, a revised battery was published in 1939 that included several changes; the consonance test was replaced by a timbre test, the term "intensity" was changed to "loudness," and the individual tests were shortened. Additional revisions included changing the original term "talent" in the name of the battery, resulting in Seashore Measures of Musical Talents (1939), thus, reflecting more accurately Seashore's position that diverse factors of musical ability are measured by the battery (George, 1980). The 1960 version, basically like the 1939 edition, is comprised of six tests, including pitch, loudness, rhythm, time, timbre, and tonal memory. Correlation studies do suggest that the Seashore measures test distinct abilities (Shuter-Dyson & Gabriel, 1981). The battery has been criticized, however, because each subtest deals with only one dimension of music. Followers of "the Gestalt theory of musical aptitude test construction" maintain that most music is made up of the interaction of rhythmic, tonal, and expressive qualities (Gordon, 1971a, p. 14).

Probably the best known musical aptitude battery, the Seashore tests have been used extensively in research. George (1980) lists approximately 200 research references in a review of musical aptitude tests (pp. 341-356). The Seashore battery is relatively inexpensive and requires only 30 minutes of actual testing time. There are no instructions or examples on the test record, however, resulting in a certain lack of standardization; each test administrator must select
examples from the test items on the record and read the instructions suggested in the manual. George suggests that the reliability of the test would be improved by re-recording the tests to include directions and examples, and to announce each item by number. He further states that the quality of current recording and reproducing equipment could improve the value of the test (p. 299). Norms are provided for the six separate tests but separate norms are not available for males and females. A composite score is not computed. Under ideal laboratory conditions, Seashore claimed that a reliability coefficient of over .90 could be obtained for the 1919 version. Yet, in practice, much lower coefficients have been recorded according to a review of studies by Shuter-Dyson and Gabriel (1981). George (1980) evaluates the Seashore battery as being "helpful for diagnostic purposes, although they seem to have little prognostic value" (p. 299).

The pioneer of musical aptitude tests, the Seashore battery has had a profound impact on music education and research. It has served as a model for later aptitude batteries, including the Kwalwasser-Dykema Music Tests and the Gretsch-Tilson Musical Aptitude Test. The Wing Standardized Tests of Musical Intelligence, a battery of seven tests, allows for a total score as well as subtest scores. Wing's test reflects a perception of musical aptitude as a unitary factor, sometimes referred to as the "omnibus" theory, a term that originated with Mursell. Gordon (1971a) reviews thoroughly nine tests of musical aptitude. Based on a summary by Gordon, a description of the nature of these batteries appears in Table 1.
Table 1. Summary Description of the Nature of Musical Aptitude Test Batteries *

<table>
<thead>
<tr>
<th>Grade or Age Level</th>
<th>Audio-Acoustical Perception</th>
<th>Tonal Concepts</th>
<th>Rhythm Concepts</th>
<th>Expressive-Interpretive Concepts</th>
<th>Achievement Skills</th>
<th># of scores for which norms are provided</th>
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</thead>
<tbody>
<tr>
<td>Seashore 1919-1960</td>
<td>Grades 4-16 and Adult</td>
<td>Pitch Discrimination (Oscillator)</td>
<td>Tonal Memory (Organ)</td>
<td>Rhythm Memory (Oscillator)</td>
<td>Consonance Preference** (Tuning Forks)</td>
<td>6</td>
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<td></td>
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<td>Intensity Discrimination (Oscillator)</td>
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<td>Time Discrimination (Oscillator)</td>
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<td>Timbre Discrimination (Oscillator)</td>
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*Adapted from Gordon, 1971, pp. 26-27.

**1919 version only.
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<tr>
<th>Grade or Age Level</th>
<th>Audio-Acoustical Perception</th>
<th>Tonal Concepts</th>
<th>Rhythm Concepts</th>
<th>Expressive-Interpretive Concepts</th>
<th>Achievement Skills</th>
<th># of scores for which norms are provided</th>
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<tbody>
<tr>
<td>Kwalwasser-Dykema 1930</td>
<td>Grades 4-16 and Adult</td>
<td>Pitch Discrimination (Oscillator)</td>
<td>Tonal Memory (Piano)</td>
<td>Rhythm Memory (Piano)</td>
<td>Tonal Movement (Piano)</td>
<td>Tonal Notation (Piano)</td>
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<td>Intensity Discrimination (Piano)</td>
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<td>Melodic Taste (Piano)</td>
<td>Rhythm Notation (Piano)</td>
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<td>Time Discrimination (Piano)</td>
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<td>Timbre Discrimination (Band Instruments)</td>
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<tr>
<td>Wing 1939-1961</td>
<td>Age 8-Adult</td>
<td>Tonal Memory (Piano)</td>
<td>Rhythmic Preference (Piano)</td>
<td>Pitch Memory (Piano)</td>
<td>Harmonic Preference (Piano)</td>
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<td>Chord Memory (Piano)</td>
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Table 1 (continued)
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<tr>
<th>Grade or Age Level</th>
<th>Audio-Acoustical Perception</th>
<th>Tonal Concepts</th>
<th>Rhythm Concepts</th>
<th>Expressive-Interpretive Concepts</th>
<th>Achievement Skills</th>
<th># of scores for which norms are provided</th>
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</thead>
<tbody>
<tr>
<td>Tilson 1941</td>
<td>Grades 4-12</td>
<td>Pitch Discrimination (Reeds)</td>
<td>Tonal Memory (Organ)</td>
<td>Tonal &amp; Rhythm Notation (Piano)</td>
<td>1</td>
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<td></td>
<td></td>
<td>Intensity Discrimination (Audiometer)</td>
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<td></td>
<td>Time Discrimination (Metronome &amp; Audiometer)</td>
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<tr>
<td>Gaston 1942-1957</td>
<td>Grades 4-12</td>
<td>Musical Memory (Piano)</td>
<td>Tonal Movement (Piano)</td>
<td>Tonal &amp; Rhythm Notation (Piano)</td>
<td>1</td>
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<td></td>
<td></td>
<td>Chord Memory (Piano)</td>
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<tr>
<td>Kwalwasser 1953</td>
<td>Form A Grade 7-Adult</td>
<td>Intensity Discrimination (Oscillator)</td>
<td>Tonal Memory (Oscillator)</td>
<td>Rhythm Memory (Oscillator)</td>
<td>1</td>
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<td></td>
<td>Form B Grades 4-6</td>
<td>Time Discrimination (Oscillator)</td>
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<tr>
<td>Grade or Age Level</td>
<td>Audio-Acoustical Perception</td>
<td>Tonal Concepts</td>
<td>Rhythm Concepts</td>
<td>Expressive-Interpretive Concepts</td>
<td>Achievement Skills</td>
<td># of scores for which norms are provided</td>
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<td>Drake 1954-1957</td>
<td>Age 8-Adult</td>
<td>Tempo Discrimination (Metronome)</td>
<td>Musical Memory*** (Piano)</td>
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<td>2</td>
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<tr>
<td>Musical Aptitude Profile 1965</td>
<td>Grades 4-12</td>
<td>Melodic Imagery (Violin)</td>
<td>Tempo Imagery (Violin)</td>
<td>Phrasing Preference (Violin &amp; Cello)</td>
<td>Tonal &amp; Rhythm Balance Preference (Violin)</td>
<td>11</td>
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<tr>
<td>Harmony Imagery (Violin &amp; Cello)</td>
<td>Meter Imagery (Violin)</td>
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<td>Style Preference (Violin)</td>
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<tr>
<td>Bentley 1966</td>
<td>Age 7-12</td>
<td>Pitch Discrimination (Oscillator)</td>
<td>Tonal Memory (Organ)</td>
<td>Rhythm Memory (Organ)</td>
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<td>1</td>
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<tr>
<td></td>
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<td>Chord Memory (Organ)</td>
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***Also includes a "time" change in some items.
There is one test that has frequently been described as superior to other available aptitude batteries (Lehman, 1968; George, 1980); that is the Gordon Musical Aptitude Profile (1965). McLeish (Buros, 1972) described the MAP as undoubtedly the best test of its kind on the market, conforming to all the criteria of excellence in musicality as well as in test construction and validation. George (1980) describes further the care with which the MAP was constructed.

When one considers all of the music aptitude tests ever constructed, one must conclude that the most extensive and most sophisticated attempt to measure musical aptitude is that represented by the Musical Aptitude Profile (MAP), authored by Edwin Gordon. Before its publication in 1965, more than six years of research and four revisions were conducted for the development of the final test battery (p. 310).

George lists approximately sixty research references to the MAP is his review of aptitude measures (p. 367).

Neurophysiological Foundations for Differences in Cerebral Processing

In the literature on neurophysiological functioning, several factors have been associated with differences in learning patterns that apply to achievement in school. There is mounting evidence that the personal attributes of sex and handedness are related to differences in the structure of the brain (Bryden, Hecaen & DeAgostini, 1983; Hecaen, DeAgostini & Monzon-Montes, 1981; Kraft, 1983; Languis & Harter-Kraft, 1985; Languis & Naour, in press; McGlone, 1978; Piazza, 1980; Spiegler, 1983; Springer & Deutsch, 1981). Age is an additional demographic factor related to brain maturation. Together these factors are important for an understanding of differences among individual learners.
Sex

According to Restak (1979) research evidence "indicates that many behavioral differences between men and women are based on differences in brain functioning" (p. 75). Women are less lateralized than men, meaning that the division of tasks processed in the separate hemispheres of the brain is less rigid in women than in men, resulting in bilateral representation to a greater degree. McGlone (1978) and Languis and Naour (in press) provide reviews of the related literature.

Differences in asymmetry have been reported between male and female infants; research has been summarized by Languis and Naour, Restak, and Springer and Deutsch. Restak indicates that girls speak earlier, have larger vocabularies, and sing in tune earlier; boys, however, demonstrate earlier visual superiority and excel at total body coordination. Languis and Naour conclude that the data may reflect a capacity for females to integrate the cerebral activity of the two hemispheres more fully than males. Language functioning tends to be represented in both hemispheres in females, whereas spatial ability tends to be weakly represented in the right hemisphere in females. Males tend to have greater hemispheric lateralization for speech and spatial skills.

Languis and Naour interpret these tendencies on the level of neural organization to be related to individual differences in approaches to learning. They propose a vector model of gender differences to explain individual variation in cerebral structure. Their model suggests that sex differences in brain structure lie along a continuum, varying in both direction and magnitude, rather than being organized in two clearly defined categories, male and female. Much is yet to be uncovered
related to the nature of sex differences and the underlying neural organization of individuals. As indicated by Languis and Naour, there is a need for research using large sample sizes in order to adequately access variation in sex differences. Evaluation that includes a more sensitive scale than the dichotomous distinction of male/female, following the vector model proposed by Languis and Naour, may yield information that to date has been undetected.

In reviewing research related to sex differences in cognitive processes Wittrock (1978) concluded that "there is no educationally relevant empirical support . . . for the belief that one sex is more or less intellectually qualified than the other to pursue academic learning" (p. 90). Yet, he noted that the observed differences in hemispheric lateralization between the sexes "reflects a richness and diversity in the use of cognitive processes to attain equivalent outcomes and equal proficiency" (p. 90).

In sum, sex differences in mean cognitive proficiency in different intellectual tasks are either nonexistent in most areas, or remarkably small in the remaining areas. They do not emerge until adolescence, suggesting an influence of culturally determined roles (p. 90).

**Age**

McGlone (1978) cites evidence that there are differences between boys and girls "in rate of brain maturation" (p. 127); she concluded that it is possible that rate of neural, physical or sexual maturation, "which differs between the sexes, may be related in a complicated fashion to hemispheric specialization before and after puberty, as well as during the early adolescent years" (p. 126). Walsh and Diller (1981)
explain the phenomenon that young children tend to be superior to adults in foreign language learning only in so far as accent is concerned:
"the earliest stage of neural development may be the most effective time for mastering pronunciation, but the later developmental stages (after puberty) are actually more pertinent to the integration of higher order linguistic processes" (p. 14). "Higher order cortical areas associated with linguistic functioning" (p. 17) are separable in function from lower order areas, are neuroplastic, and develop over several years, possibly two to three decades; lower order areas (aptitudes) are neuroplastic and develop earlier. Walsh and Diller explain the "seemingly contradictory evidence on the optimum age for second language learning" (p. 18) as follows:

Lower-order processes such as pronunciation are dependent on the early maturing and less adaptive macroneural circuits, which makes foreign accents difficult to overcome after childhood. Higher-order functions, such as semantic relations, are more dependent on the late maturing neural circuits, which may explain why college students can learn many times the amount of grammar and vocabulary that elementary school students can learn in a given period of time. As people grow older and cognitively more mature, their increasing higher-order cortical functions allow them to do more than they could before with their lower-order aptitudes and functions. From an understanding of the neural substrates involved . . . [in] learning language, we can understand how different aspects of language are learned optimally at different ages (p. 18).

Research in brain growth spurts has revealed that after age ten, a very real difference in the growth of brain weight and head circumference exists between the sexes. Such growth spurts have been found to correspond to mental growth spurts (Epstein, 1978). In a longitudinal study by Eichorn and Bagley (cited in Epstein, 1978, p. 351), girls'
head circumference increased about twice as much as boys between ages 10 to 12; whereas, at around age 15, the growth spurt reversed itself across the sexes. Epstein interpreted the Eichorn and Bagley research to imply the need for different curricula for boys and girls at the first growth spurt, as well as throughout the period of schooling that follows. The impact of an inadequate or inappropriate program for either group, male or female, may prove harmful or result in deprivation. If girls are not challenged when they are ready for intense growth, they may be deprived of the background necessary for their subsequent mental growth. Conversely, if boys develop a negative self-concept in relationship to their academic ability because they are challenged beyond their limits during the 10 to 12 year-old period, they may not benefit from the natural brain growth spurt when it occurs for them around age 15, a time when girls may experience a plateau effect in growth.

Evidence in auditory foreign language educational research has supported this position that sex differences seem to relate to academic performance at different ages. In a study with 283 French and 177 Spanish students at the university level the large number of significant differences between the sexes (variables that included measures of English, reading, intelligence, and the Seashore subtests of pitch and time) led the researchers to conclude that there is a need to study the sexes separately on successive inquiries into language learning (Leutenegger, Mueller & Wershow, 1965). Using multiple regression techniques, language acquisition prediction equations were developed by Leutenegger, Mueller, and Wershow for female students of French
Pimsleur, Stockwell, and Comrey (1962) found that sex correlates with high school foreign language grades; the negative correlation coefficient (-.58) indicated that girls outperformed boys. The same research indicated that sex failed to correlate significantly with either of the two French achievement measures—final French II grades (-.02) or a French speaking proficiency test (-.08)—at the university level for the same students.

**Handedness**

The handedness preference of an individual is another variable thought to relate to his or her cerebral functioning. The range of diversity lies along a continuum, extending from pure right-handedness to pure left-handedness (Annett, 1970); the organization of the brain corresponding to handedness varies in several ways. Most right-handers, approximately 95% of the population in western cultures (Languis & Naour, in press; Springer & Deutsch, 1981), process language in the left hemisphere.

The dominant hemisphere for language processing in left-handers is less clearcut. Some process language in the right hemisphere, whereas others are thought to "have language mediated by the left hemisphere (i.e., ipsilateral or same side hand-language hemisphere) and can be expected to have diffuse neural organization and either spatial or verbal deficits" (Languis & Harter-Kraft, 1985). Left-handers seem to be less lateralized than right-handers (Annett, 1970; Languis & Harter-Kraft, 1985; Lishman & McMeekan, 1977). Kraft (1981) found that right-handed and ambidextrous subjects who have left-handed
family members have greater bilateral processing for verbal and nonverbal input. In investigating interrelationships among strength of handedness, familial handedness, and sex she concluded that family handedness patterns must be considered as well when intellectual and cognitive performance is assessed. In a study by Spiegler (1983) both right and left-handers reported incidence of familial sinistrality (left-handedness) with approximately the same frequency (39% versus 42%). In addition, Spiegler found that the contribution of the mothers' handedness affected both daughters and sons although that of fathers related only to sons. (These findings agree with those of Annett, cited in Spiegler.)

**Hemispheric Differences**

The human cortex is divided into two hemispheres which, to some extent, serve different cognitive functions. The left hemisphere has primary responsibility for processing visual and tactile information from the right side of space, and the control of movements of the right arm and leg. Conversely, the right hemisphere is dominant for visual pattern recognition, some types of music processing, and spatial visualization and orientation (Languis & Harter-Kraft, 1985, p. 330).

As Languis and Harter-Kraft indicate, differences in hemispheric functioning have been studied in normal and brain-damaged patients using a variety of techniques, including sodium amytal tests, dichotic listening tests, tachistoscopic presentations, electroencephalographic (EEG) measures of electrical activity in the brain. It is, however, the integrated functioning of the brain that researchers are coming to view as of primary importance, rather than hemisphere in which processing initially seems to be taking place.
Languis and Harter-Kraft have summed the literature on cerebral functioning into five statements:

1. The two hemispheres of the brain process experience differently. The left hemisphere processes information sequentially and analytically, part by part. It focuses on and remembers verbal components of learning. The right hemisphere, in contrast, processes information from the same experience as a whole, simultaneously and synthetically, with a focus upon spatial components and remembers images.

2. Developmental changes that occur in the brain seem clearly related to function. Some parts of the brain mature and become fully functional earlier than other parts. The brain has more adaptive plasticity in young children than in older persons.

3. There are several sources of individual difference in brain functioning, developmental patterns, differential brain organization, and preferred functioning patterns.

4. Thus, differences between children in their characteristic approach to school tasks—frequently labeled cognitive styles or learning styles—may reflect the specialized processing of the brain's hemispheres.

5. An individual's brain-processing patterns appear to be the result of neural organization that probably is based on heredity and environmental factors (Languis & Harter-Kraft, 1985, pp. 334-335).

The complexity of analyzing cerebral processing and the related variables of sex, age, and handedness is complicated further by "differences in the way a task is approached" (Springer & Deutsch, p. 144). Moreover, the nature of the task to be processed may be an important factor in determining how the brain approaches the task. As neurophysiological and educational researchers have begun to focus on the mental activity that takes place within a student during the processing of school tasks, it has become increasingly evident that a wide range of variation in cerebral processing exists. According to
Languis and Harter-Kraft, "the most striking impression from more than twenty years of brain research is the validation of human differences" (p. 344). An understanding of factors that relate to differences in the structure of the brain, such as handedness, age, and sex is important to educators to enable them to arrange conditions for learning that are appropriate to the students in the learning process.

In Chapter II a review of the literature considered to be important for theoretical and empirical foundations for this study has been presented. To provide an understanding of auditory foreign language perception, the role of rhythm as an organizer of speech perception was hypothesized. Foreign language aptitude and musical aptitude tests, and the constructs they purport to measure, were reviewed. Studies that have related musical aptitude to foreign language aptitude during the past fifty years were summarized. Finally, the neurophysiological attributes of sex, age, handedness, and hemispheric functioning were briefly introduced as factors contributing to individual cerebral differences.

In Chapter III the data collection procedures, instrumentation, and statistical analyses used in the study will be explained.
CHAPTER III

PROCEDURES

The procedures for this longitudinal research project are best described in two phases: Phase I encompassed all data collected during a nine-month period prior to the time that the subjects began the study of a foreign language; during Phase II of the study measures of foreign language achievement in French, German, or Spanish were administered. In this chapter, a detailed description of the procedures is provided: the subjects; the instruments used to measure factors of pertinence to the study, including the development of researcher-made instruments and subsequent pilot studies; data collection procedures; and statistical analyses.

Population

The subjects for this study included all eighth grade students enrolled in the public schools of the Titusville (Pennsylvania) Area School District during the six-month period from May 1981 to December 1981, who subsequently studied a modern foreign language—approximately 100 students. This northwestern Pennsylvania school district encompasses 196 square miles, composed of the city of Titusville (population 6,812, according to the 1981 city registry), five towns, three boroughs, and rural territory. Titusville is the geographic, economic, and social center for the school district. Although the
residents of the district live in three different counties (Crawford, Warren, and Venango), they are located within a ten-mile radius of Titusville and are served by the same newspaper and radio station. Less than four-tenths of one percent of the total school enrollment was of a minority background—eight Asian and three Afro-American students in a total student population of 3,100 during May 1981.

Eighth grade students were chosen as a population for the initial phase of data collection for two reasons: to test students who had not previously studied a foreign language and to test subjects whose musical aptitude and cognitive development had approached that of adults to the greatest degree possible, without prior foreign language experience. It is generally acknowledged that musical aptitude has stabilized before grade seven (deYarmen, 1975; Gordon, 1984; Schleuter & deYarmen, 1977). Cognitive development in most adolescents has reached Piaget's stage of formal operations between ages 11 to 15 years. Such an adolescent has the structural equipment to think like an adult.

The eighth grade students of this school district may opt to study Latin, French, Spanish, or German in ninth grade. A group of gifted seventh and eighth grade students was scheduled to begin the study of French in January 1981 as part of an experimental program. The program was subsequently rescheduled to exclude the subjects of this investigation; nevertheless, data had been collected prior to the proposed experimental program to avoid having perhaps the most capable students eliminated from the study because of foreign language classroom instruction.
Although the sample is one of convenience, it can be considered
generalizable to other similar populations, namely, secondary school
students in small town school districts with a small minority population.

Research Design and Variables

This study utilizes an **ex post facto** correlational design to
investigate existing relationships among measures of student aptitude,
musical experience, achievement, and selected personal attribute
variables. While a portion of the data was available from school
records, the major part resulted from tests given by the researcher
expressly for this study.

The data collected in both Phase I and Phase II of the study were
subjected to four statistical procedures: (1) first-order correlational matrices were developed to examine correlational relationships between all the variables, using the Pearson Product-Moment Correlation formula; (2) canonical regression analysis, a procedure seldom used in research on foreign language aptitude (Carroll, 1981, p. 101); (3) step-wise multiple regression analysis; and (4) MANOVAs. A "multivariate extension of multiple regression" (Scholl, 1981, p. 182), canonical regression analysis, can be used with "proper caution in interpretation, . . . to make inferences about what aspects of predictor variables are most highly associated with what aspects of criterion performance" (Carroll, 1981). Described as an analysis "yielding the 'most predictable criterion,' . . . sometimes with the implication that the most predictable criterion is not necessarily the
criterion one wishes to predict," canonical analysis is also characterized by Carroll as "yielding the most predictive sets of predictor variables with the sets of criterion variables of which each is most predictive" (p. 101). Essentially, all relationships among all variables are considered. Step-wise multiple regression procedures were conducted to investigate relationships between multiple predictor variables and each of the criterion variables in order to provide additional information about the data initially analyzed by canonical regression procedures. MANOVA procedures were utilized to analyze data that did not meet the interval data requirement necessary for canonical or step-wise multiple regression analysis. These data were subjected to univariate follow-up procedures (ANOVA).

Phase I

In Phase I of the study complete data for 24 variables were obtained on 145 subjects. Although partial data were collected for 251 subjects, only those for whom complete data were available were included in analysis. Twelve students had had contact with a foreign language, either at home or in school, prior to data collection for Phase I; therefore, they also were eliminated from the analysis. This decision was made after an extensive descriptive work-up of the data was conducted, which revealed significant differences between the group of students having had prior foreign language contact and those who had had none. Therefore, 133 subjects were part of the Phase I final analyses. The relationships among 24 measures were analyzed through canonical analysis and stepwise multiple regression
procedures; the criterion and predictor variables of Phase I are listed below.

CRITERION VARIABLES: PHASE I

c-1) Pimsleur Sound Discrimination (PLAB^5)
c-2) Pimsleur Sound-Symbol Association (PLAB^6)
c-3) Pimsleur Auditory Total (PLABTOT)
c-4) Syllable Discrimination Test: Count (COUNT)
c-5) Syllable Discrimination Test: Accent (ACCENT)

PREDICTOR VARIABLES: PHASE I

p-1) MAP Tonal Imagery, Part I: Melody (T^1-TONAL)
p-2) MAP Rhythm Imagery, Part I: Tempo (R^1-TEMPO)
p-3) MAP Rhythm Imagery, Part II: Meter (R^2-METER)
p-4) MAP Rhythm Imagery, Total (RHYTHMTOT)
p-5) MAP Musical Sensitivity, Part I: Phrasing (S^1-SENSITIV)
p-6) MAP Total (MAPTOT)
p-7) IOWA Vocabulary (VOCAB)
p-8) IOWA Reading (READ)
p-9) IOWA Language: Spelling (SPELL)
p-10) IOWA Language: Usage (USAGE)
p-11) IOWA Language: Total (LSKILLSTOT)
p-12) IOWA Work Study Skills: Visual Materials (WORKVIS)
p-13) IOWA Work Study Skills: Total (WTOT)
p-14) IOWA Mathematics: Concepts (CONCEPTS)
p-15) IOWA Mathematics: Problems (PROB)
p-16) IOWA Mathematics: Computation (COMPUT)
Two predictor variables, sex (SEX) and handedness (HAND), yielding categorical data, were analyzed in separate MANOVA procedures apart from the regression procedures. (Categorical data cannot be processed validly in canonical or regression analysis.)

The results of these preliminary analyses are reported in Chapter IV. On the basis of these results, it was decided to retain the Syllable Discrimination Test, Part I (COUNT) and Part II (ACCENT) in the final analysis of the data of the main study and to define Auditory Foreign Language Perception in terms of PLAB$^5$ and PLAB$^6$ and the two subtests of the Syllable Discrimination Test (COUNT and ACCENT).

Phase II

In the analysis of data collected in Phase II of the study the criterion variables were analyzed using the same statistical procedures used in the analysis of Phase I: the Pearson Product-Moment formula to establish first-order correlations; canonical correlation analysis and stepwise multiple regression follow-ups to further analyze relationships found between sets of correlates; and a MANOVA to analyze the effects of the categorical data yielded by the sex and handedness variables.

In this second phase, two criterion variables, defined operationally in Chapter I (p. 11) were analyzed. These measures of auditory
foreign language achievement are (1) Auditory Total (AUD TOT), consisting of Part I A and B, Part II, and Part III, and (2) Auditory Question/Written Personal Response (AUD IV).

CRITERION ACHIEVEMENT VARIABLES: PHASE II
1) Auditory Total (AUDTOT)
2) Auditory Question/Written Personal Answer (AUD IV)

Instrumentation

Iowa Test of Basic Skills (IOWA) (1978)

Prior academic achievement was measured by scores on Form 7, Level 13 of the Iowa tests of Basic Skills (Hieronymus, Lindquist, & Hoover, 1978) obtained from school records. The entire battery of tests requires about five hours to administer, four hours and four minutes of which is working time. The organization of the battery and the number of items in each subtest are provided in Figure 2. All test items require the student to select the correct "multiple choice" answer.

The basic skills are defined in the test manual (Hieronymus, Lindquist, & Hoover, 1979, 1978) in the following terms:

Vocabulary--reading and knowing the meanings of words

Reading--understanding what you read

Language--spelling; capitalization; punctuation; use of words

Work-Study Skills--reading maps, graphs, and tables; alphabetizing, using an index, the dictionary, and similar materials; and finding information in the library

Mathematics--understanding the number system, mathematical terms and operations; solving problems; computation (p. 12).
<table>
<thead>
<tr>
<th>Name of Test</th>
<th>Testing Time</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test V: Vocabulary</td>
<td>15 minutes</td>
<td>43</td>
</tr>
<tr>
<td>Test R: Reading</td>
<td>42 minutes</td>
<td>57</td>
</tr>
<tr>
<td>Test L: Language Skills</td>
<td>52 minutes</td>
<td>--</td>
</tr>
<tr>
<td>L-1: Spelling</td>
<td>12 minutes</td>
<td>43</td>
</tr>
<tr>
<td>L-2: Capitalization</td>
<td>12 minutes</td>
<td>31</td>
</tr>
<tr>
<td>L-3: Punctuation</td>
<td>14 minutes</td>
<td>31</td>
</tr>
<tr>
<td>L-4: Usage</td>
<td>14 minutes</td>
<td>31</td>
</tr>
<tr>
<td>Test W: Work-Study Skills</td>
<td>65 minutes</td>
<td>--</td>
</tr>
<tr>
<td>W-1: Visual Materials</td>
<td>40 minutes</td>
<td>52</td>
</tr>
<tr>
<td>W-2: Reference Materials</td>
<td>25 minutes</td>
<td>47</td>
</tr>
<tr>
<td>Test M: Mathematics Skills</td>
<td>70 minutes</td>
<td>--</td>
</tr>
<tr>
<td>M-1: Mathematics Concepts</td>
<td>25 minutes</td>
<td>42</td>
</tr>
<tr>
<td>M-2: Mathematics</td>
<td>25 minutes</td>
<td>30</td>
</tr>
<tr>
<td>M-3: Mathematics</td>
<td>20 minutes</td>
<td>45</td>
</tr>
<tr>
<td>Computation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Iowa Tests of Basic Skills

The twelve scores included in the analysis are: vocabulary; reading; three language skills scores (spelling, usage, total); two work study scores (visual materials, total); four mathematics skills scores (concepts, problems, computations, total); and the composite of the Iowa Tests.

Gordon Musical Aptitude Profile (MAP) (1965)

Four subtests of the Gordon Musical Aptitude Profile (Gordon, 1965a, 1965b) were used to measure the musical aptitude of the subjects: Tonal Imagery-Melody, Rhythm Imagery-Tempo, Rhythm Imagery-Meter, and Musical Sensitivity-Phrasing. (Tonal Imagery-Harmony, Musical Sensitivity-Balance, and Musical Imagery-Style will not be used due to the length of the tests.)
Melody, Tempo, and Meter subtests each contain 40 items performed on violin. Each item presents a short musical "statement" and an "answer." The subject is asked to decide whether the answer is "like" or "different" from the statement. If the subject is in doubt, the answer "undecided" may be selected. The phrasing subtest consists of 30 items played by violin and cello. The subject hears two renditions of a short musical statement which differ only in phrasing. The subject is asked to decide which version is better or to indicate "undecided."

Reliability coefficients, computed by split-half procedures and the Spearman-Brown formula, were provided in the manual for each of nine grade levels (4-12). Standardized coefficients for eighth grade students that were provided in the MAP manual (Gordon, 1965a) are listed in Table 2. The composite reliability coefficient reported in the manual for the eighth grade level for the MAP was .95; as the present study does not include all the MAP subtests, there was no comparable score.

Table 2. MAP Reliability Coefficients from MAP Manual

<table>
<thead>
<tr>
<th>Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonal Imagery-Melody</td>
</tr>
<tr>
<td>Rhythm Imagery-Tempo</td>
</tr>
<tr>
<td>Rhythm Imagery-Meter</td>
</tr>
<tr>
<td>Rhythm Imagery-Total</td>
</tr>
<tr>
<td>Musical Sensitivity-Phrasing</td>
</tr>
</tbody>
</table>

(Gordon, 1965a, p. 50)
Reliabilities for each of the MAP subtests used in this study (Table 3) were computed by the sub-program RELIABILITY in SPSS (Statistical Package for the Social Sciences, 1980) using Kuder-Richardson, a version of Chronbach's Alpha.

Table 3. MAP Reliability Coefficients for Main Study

<table>
<thead>
<tr>
<th>Grade 8</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonal Imagery-Melody ($T^1$)</td>
<td>.76</td>
</tr>
<tr>
<td>Rhythm Imagery-Tempo ($R^1$)</td>
<td>.77</td>
</tr>
<tr>
<td>Rhythm Imagery-Meter ($R^2$)</td>
<td>.78</td>
</tr>
<tr>
<td>Rhythm Imagery-Total (RTOT)</td>
<td>--</td>
</tr>
<tr>
<td>Musical Sensitivity-Phrasing ($S^1$)</td>
<td>.74</td>
</tr>
</tbody>
</table>

Among the intercorrelations reported in the test manual, the score that correlates most highly with the composite score for the MAP battery at the eighth grade level is that of Rhythm Imagery-Total (coefficient .89).

The Gordon Musical Aptitude Profile is a highly respected instrument in the field of musical aptitude testing (McLeish, 1972; Lehman, 1968, p. 54; Suter-Dyson & Gabriel, 1981). The test relies on musical memory to a large degree and measures higher level functions of musical aptitude than the discrete skills measured by the Seashore battery. Published in 1963, the MAP is the most recent music aptitude test available. Its impressive reliability and validity make it highly desirable to use in the present study in spite of the length of time required to administer the four subtests chosen (67 minutes).
Instructions and test items are recorded on reel-to-reel magnetic tape at 7½ rpm.

**Pimsleur Language Aptitude Battery (PLAB) (1965)**

Pimsleur devised the PLAB to measure three components of language aptitude: verbal intelligence, motivation, and auditory ability. In the PLAB, "the ability to receive and process information through the ear" (Carroll, 1981) is measured by two subtests: Sound Discrimination (PLAB<sup>5</sup>) and Sound-Symbol Association (PLAB<sup>6</sup>). The Sound Discrimination measure consists of 30 items that require the student to distinguish between three words of the West African language Ewe. Differentiated by pitch, orality, and nasality, the words are used in sentences of increasing complexity; the ability to distinguish meaning within a context is thus evaluated. The Sound-Symbol Association subtest, composed of 24 items, assesses the student's ability to associate sounds with a written form. The student hears a spoken nonsense word and determines which of the possible spellings is the correct one. All instructions and test items are recorded on reel-to-reel magnetic tape at 7½ rpm.

The auditory subtests of the Pimsleur instrument were selected for this study for three reasons:

1. It is appropriate for the junior high school level, as well as older students.

2. The Sound Discrimination measure utilizes an African language, Ewe, that requires phonemic oral versus nasal distinctions and tonal distinctions, thereby
encompassing phonemic difficulties confronted for students learning either French (the nasals) or Japanese (a tone-accent language) or Chinese (a tone language).

3. Two measures of Phonetic Coding Ability, as described by Carroll (1981, p. 107) including a total of 54 auditory test items, compose the auditory section of the PLAB.

Main study reliability coefficients for the two subtests of the PLAB were computed using the Kuder-Richardson 20 formula by the SPSS subprogram, RELIABILITY. Reliabilities of .77 (PLAB^5) and .65 (PLAB^6) were calculated.

**Syllable Discrimination Test (SDT)**

The Syllable Discrimination Test (SDT), developed by the researcher, is based on a subtest of the Botel Reading Inventory (1961, 1966). As in the original test, ten English words are pronounced. The student is required to determine if the word contains one, two, three, or four syllables. The words are read a second time; the student is asked to detect which syllable is accented. This same procedure is followed for four other languages: German, Spanish, French, and Japanese. There are a total of 100 items in the test: 50 in each of the subtests, Number of Syllables and Accented Syllable. The SDT utilized Form A of the Botel (1961) test as the English word base-line component. Subsequently, ten words were selected in each of four foreign languages: German, Spanish, French, and Japanese. Three commonly-taught languages, which are options for the subjects of the
study to elect in ninth grade, and a tone-accent language (Japanese) were chosen to be part of the test.

The same distribution of words of one, two, three, or four syllables that was used in the English word list was adhered to in choosing the words in the four other languages. The variation of syllabic stress patterns and vowel-consonant combinations characteristic of each language were considered using the Delattre (1965) analysis of German, French, and Spanish and the Mitzutani and Mitzutani (1977) analysis of Japanese as guidelines. (Development of the initial form of the SDT and subsequent piloting sessions are described more fully in this chapter in the section entitled Pilot I, p. 69). Faculty members from The Ohio State University who are native speakers of the languages in question, as well as knowledgeable in linguistics, assisted in selecting words. Subsequently, tapes were recorded for the main study by male native speakers in the WOSU radio recording studio on reel-to-reel magnetic tape at 7½ rpm. The tapes were validated by a second native speaker in each of the languages in question prior to piloting to ensure authenticity and representativeness of language.

Syllable Discrimination Tests (SDT) reliability coefficients for the main study were assessed using the subprogram RELIABILITY in SPSS, resulting in Kuder-Richardson 20 reliability coefficients of .81 (SDT: COUNT) and .79 (SDT: ACCENT). These were confirmed in a second piloting session at Bexley Senior High School (Bexley, Ohio) in which reliability coefficients of .87 resulted for each of the SDT subtests.
Personal Background Questionnaire (PBQ)

The Personal Background Questionnaire (PBQ), developed by the researcher, requests demographic information of interest to the study: gender, age, native language, languages spoken, handedness, and participation in school musical organizations. (PBQ and instructions to the homeroom teachers for administering it are in Appendix A.) Questions concerning handedness were selected from a questionnaire by Annett (1970). Musical experience, as measured in the questionnaire, is based on Gordon's MAP, requesting information on both the length and type of musical experiences, including private lessons as well as public school formal learning and participation.

Auditory Foreign Language Achievement Tests

Auditory achievement measures were developed in French, German, and Spanish by the researcher in cooperation with the three foreign language teachers who instructed the subjects of the study. Each test is composed of 15 purely auditory items (eight auditory multiple-choice questions and answers and seven auditory multiple-choice with a drawing), four sound-symbol association items, a thirty-word dictation and five personal questions. Content validity for the first year courses in French, German, and Spanish at Titusville Junior-Senior High School was determined by the researcher in consultation with each of the three language instructors. Using the textbook material covered by the teachers, namely, French for Mastery (Valette & Valette, 1975), German Today: One (Moeller, Liedloff, Hoelzel, Simmons & Tangert, 1976) and El español al día: Book 1 (Turk & Allen, 1973), test
content was established by confirming textbook content with that of the 0+ and 1 classifications (Novice-High and Intermediate) of the ACTFL Provisional Proficiency Guidelines (Higgs, 1984); these classifications provided a framework to check the content of the tests against a normalized standard for content validity appropriate to the end of a first full year of language study.

Test development included the following stages: preliminary discussions in January 1983 with the Titusville language teachers concerning the projected textbook content to be covered during the first year classes; discussion of proposed test content, format, and types of test items in March 1983; during August 1983, development of the first draft of the French test by the researcher, and of the German and Spanish first drafts by certified secondary teachers who have also taught at the college level; verification of content validity and item accuracy by the Titusville foreign language teachers; recording of the tests by native speakers and subsequent piloting. A description of this final procedure follows in the next paragraph.

In early October 1983 the three tests were recorded by male native-speakers in professional sound studios by professional engineers at The Ohio State University (French) and the State University of New York College at Fredonia (German and Spanish). All tests were edited by the researcher and a professional engineer in the Media Center at the State University of New York College at Fredonia. Preliminary piloting was done for each of the tests on a volunteer basis by college students in Fredonia. After additional editing of the Spanish test and
a re-recording of the German test, all three tests were piloted in foreign language classes in New York State schools in the Fredonia vicinity. The foreign language background of the students involved in the pilot testing was comparable to that of the subjects for the main study although the pilot subjects had not used the textbooks for which the tests were devised. The French and Spanish tests were piloted at Jamestown High School on October 17, 1983, and the German test was piloted at Southwestern High School on October 18, 1983. The teachers and students provided feedback to the researcher in written form. Subsequently, additional editing and a correction to the German test were accomplished prior to delivering the master tapes to Titusville High School teachers with the auditory test packets on October 19, 1983 for the October 20th main-study data collection. As mentioned above, items were constructed to test auditory discrimination and comprehension skills in isolation and in combination with reading or writing skills.

Data Collection Procedures

The cooperation of selected subject-area teachers and the homeroom teachers of all eighth grade sections was requested by the principal during a faculty meeting in May 1981. Prior to the days of testing the researcher met in small groups with the teachers whose students were involved to answer questions concerning the nature of the study, to ensure their understanding of their role in the study, to distribute materials, to explain testing procedures, and to train those who needed help in operating the reel-to-reel tape recorder.
All measures were administered with consideration for optimum possibilities of full attendance of the subjects for the study, i.e., to avoid the day when yearbook photos are taken and the first day of doe-hunting season, and to allow the researcher to be present, if possible. However, due to the many measures involved (nine sessions of testing specifically for the main study and numerous sessions for Iowa tests administered by the school), complete data were not obtained for all possible subjects. Dates for the administration of all measures were determined through cooperative decisions by the administration, the teachers involved, and the researcher. The researcher made every attempt to avoid disruption to the regular operation of the school and to the subjects and teachers, without sacrificing the integrity of the research measures. In addition to the consideration that standard decorum dictates, this seemed advisable because of the large number of measures involved in the study, the length of contact time needed with the students, and the involvement of all eighth grade homeroom teachers. The only interruption of the school schedule was a delay of passing bells to allow for the completion of the PBQ during the homeroom period, thereby affecting the entire junior high school on the morning of the last day of testing.

Phase I

Initial data collections were conducted at the Titusville Junior High School during the period following final seventh grade exams and mid-year of grade eight for the subjects of the study (between May 31 and December 20, 1981). In the spring of 1981 the researcher
administered the two auditory subtests of the Pimsleur Language Aptitude Battery and the Syllable Discrimination Test in the English and social studies classes on days subsequent to the completion of final examinations in those classes. The four subtests of the MAP were administered by the music and math teachers in a three-week period between Thanksgiving and Christmas vacation. The final instrument of Phase I, PBQ, was completed in the eighth-grade homerooms during homeroom period on December 17, 1981.

The following schedule was observed:

<table>
<thead>
<tr>
<th>Day</th>
<th>Name of Test</th>
<th>Testing Situation</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>PLAB^5 (Sound-Discrimination) and PLAB^6 (Sound-Symbol Association)</td>
<td>English class</td>
<td>18&quot;</td>
</tr>
<tr>
<td>II</td>
<td>SDT (Syllable Discrimination)</td>
<td>Social Studies class</td>
<td>20&quot;</td>
</tr>
<tr>
<td>III</td>
<td>MAP Melody and MAP Phrasing</td>
<td>Math class</td>
<td>31&quot;</td>
</tr>
<tr>
<td>IV</td>
<td>MAP Tempo and MAP Meter</td>
<td>Music class</td>
<td>36&quot;</td>
</tr>
<tr>
<td>V</td>
<td>Personal Background Questionnaire (PBQ)</td>
<td>Homeroom period</td>
<td>10&quot;</td>
</tr>
</tbody>
</table>

Pilot Studies for Phase I

Pilot I. Administrative procedures and materials to be used in the main study were tested in six seventh-grade social studies or English classes in Titusville Junior High School in May 1980. Each of the classes was given one or two of the eight instruments. All instruments were administered in this pilot in order to (1) establish procedures; (2) examine the clarity of instructions of the instruments; (3) verify the aural quality of all taped instruments; (4) determine the length of auditory testing time appropriate to
junior high school students; (5) provide information in the refinement process of the two instruments developed by the researchers (SDT and PBQ); and (6) establish reliability coefficients.

In the original conception of this study, the entire Musical Aptitude Profile (MAP) was to be administered. Because of the fatigue caused to the students and the expenditure of 110 minutes of testing time, it did not seem justifiable to give all seven subtests. Upon consultation, Gordon, author of the MAP, suggested four subtests that he considered essential to the present study: Melody, Tempo, Meter, and Phrasing. This reduced the aural testing time for the MAP to 67 minutes. Gordon also reassured the researcher that, used in their entirety, the subtests could be administered without distorting their reliability. According to the MAP author, student listening fatigue is lessened by turning the TREBLE down and the BASS up.

The taped portion of the Pimsleur Aptitude Battery (PLAB) was returned to the publisher for replacement due to volume inconsistencies in the recording. When questioned, the students in the pilot group had not considered the tape difficult to hear; however, the researcher felt that these differences in volume caused unnecessary anxiety in some students who visibly had reacted to the volume differences.

The Syllable Discrimination Test (SDT) was developed by the researcher and recorded on audio tape in the Allegheny College language laboratory recording facilities by native speakers of English, Spanish, German, French, and Japanese. The pilot study revealed that the quality of the SDT was deficient in three ways:
the volume and clarity of the recording varied throughout the tape; the pronunciation of one of the speakers tended toward animated rather than standard pronunciation, reflecting the stress pattern of emphatic or emotional speech instead of "logical" stress (Delattre, 1962, 14-2) characteristic of habitual speech; and the choice of certain French and Japanese words was questionable due to ambiguity in keying the correct responses.

The SDT tape was redeveloped to avoid ambiguities in the French subtest by omitting words in which the final consonant sound(s) required the semi-pronunciation of the [ə]. This beginning of a vowel that is heard as part of the French final consonant release (détente des consonnes finales) is designated by the use of a trema ("e") in the work of Delattre (1948, pp. 3 and 45). This final consonant release may be heard by non-francophones as another syllable, although it is not considered such by linguists. In actuality it is an extension of "open syllabication," the tendency of the French syllable to end in a vowel sound, characteristic of the French language (Delattre, 1951, p. 64). It was decided to exclude words in the French subtest that ended with the phonemes that result in this auditory phenomenon: b", d", f", g", k", l", m", n", p", r", s", t", v", ks", "e", "u", and combinations of the preceding sounds with [l] or [r] (Delattre, 1948, pp. 44-45).

In revising the Japanese subtest careful attention was given to three differences in the perception of a syllable in Japanese and English. In Japanese vowel length can determine a syllable. As vowel length does not define a syllable in English, the double o of
the word dooshite is perceived as one sound by an English-speaking listener. The word kirei posed another problem relating to vowel length as a definition of a syllable. Kirei is a three-syllable Japanese word. The English diphthong accustoms the English-speaking listener to vowel changes within a syllable. It was decided to avoid this word to ensure that the two final vowels of kirei, perceived unquestionably as two by a Japanese listener, would not be perceived as one diphthong because of the expectations of an English-speaking listener.

A second problem relating to the perception of English and Japanese syllables resulted in the replacement of shimasu and varimasu. Both of these three-syllable words become two syllables in conversation because of the tendency of the Japanese language to drop the final u when it is preceded by an unvoiced consonant, in this case, s. The English-speaking listener would perceive one less syllable than the word contains.

The final n of the word hon poses a third problem for the English-speaking listener. The n is a syllabic consonant; therefore, the word is a two-syllable word. The word ni was substituted to provide a one-syllable word.

The Kuder-Richardson reliability coefficients, using the sub-program RELIABILITY of SPSS, computed for the two Syllable Discrimination subtests were .72 (SDT: COUNT) and .74 (SDT: ACCENT).

In summary, the following modifications resulted from information obtained in the first pilot study:
1. Instead of seven, four subtests of the Gordon MAP were employed.

2. The PLAB test tape was replaced with a version improved from a technical standpoint.

3. The SDT tape was changed in that certain Japanese and French vocabulary items were substituted to avoid predictable ambiguities for English-speaking listeners.

4. The PBQ was refined to ensure clarity.

Pilot II. Subsequent to the main study a second pilot was conducted at Bexley High School in Bexley, Ohio for the purpose of confirming reliability coefficients for the PLAB tape and the Syllable Discrimination Test. Acoustics in the room where these tests were administered for the main study caused concern about the reliability of the taped instruments. Permission was obtained from the Bexley administration to pilot the tests in question in two French classes during November 1981. Kuder-Richardson reliability coefficients obtained in the Bexley pilot—.87 for each of the Syllable Discrimination subtests (SDT: COUNT and SDT: ACCENT) and .68 for the PLAB—reassured the researcher that the data collected during Phase I was reliable in spite of questionable acoustic conditions.

The coefficient for the PLAB (.37) was surprisingly low as compared to the PLAB coefficient calculated for Pilot I (.61) and for Phase I of the main study (.65). This may be explained by the high ability level of the subjects used for the Bexley PLAB pilot—13 very select language students. Seven of the possible 24 items had zero variance because all students answered them correctly. This resulted in the reliability being calculated on 17 instead of 24 items,
whereas, variance resulted for all 24 items in the main study and Pilot I.

**Phase II**

Auditory achievement data in French, German, or Spanish were collected by the classroom teachers on October 20, 1983 for subjects who had studied foreign language during one full year and had reviewed the content of the first year's work at the beginning of the second year. The classroom teachers were provided with testing procedures to be followed (Appendix D), student test copies (Appendix A), and a reel-to-reel examination tape with tape script (Appendix A). All instructions to the students were recorded on the test tape and appeared on the written student test copy. Tests in the three languages were given on the same day with controlled instructions in order to standardize testing conditions to the greatest possible degree within the normal classroom setting.

Complete data for Phase II, encompassing those of Phase I, were obtained for 54 tenth-grade students (14 French, 20 German, and 20 Spanish). Main study tests were scored by two raters for each set of tests—French, German, and Spanish. Raters were certified secondary school teachers of the language in question who also had teaching experience at the university level, either as full-time instructors or teaching assistants. Instructions for scoring were developed by the researcher and one scorer in each language during the rating of the pilot tests. The procedure and a set of guidelines for scoring were provided to the main study raters (Appendix B). To determine the
inter-rater reliability of the scoring procedure, Pearson Product-Moment correlations between the two sets of rater scores were calculated, resulting in the coefficient provided in Table 4.

Table 4. Inter-rater Reliability Coefficients for the Auditory Achievement Tests in French, German and Spanish

<table>
<thead>
<tr>
<th>Achievement Measure</th>
<th>r</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>.98</td>
<td>14</td>
</tr>
<tr>
<td>German</td>
<td>.99</td>
<td>20</td>
</tr>
<tr>
<td>Spanish</td>
<td>.97</td>
<td>20</td>
</tr>
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</table>

Reliability coefficients were calculated for the total achievement test scores for the pilot study, and for the total achievement tests scores for the two subdivisions of the main study using the subprogram RELIABILITY of SPSS. The Kuder-Richardson 20 coefficients for the pilot are given in Table 5.

Table 5. Reliability Coefficients for Auditory Achievement Tests in French, German, and Spanish—Pilot Study

<table>
<thead>
<tr>
<th>Achievement Test</th>
<th>Reliability</th>
<th>No. of Items</th>
<th>No. of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>.86</td>
<td>66</td>
<td>23</td>
</tr>
<tr>
<td>German</td>
<td>.87</td>
<td>65</td>
<td>20</td>
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<tr>
<td>Spanish</td>
<td>.82</td>
<td>64</td>
<td>17</td>
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</tbody>
</table>

Reliability coefficients for auditory achievement tests for the main study are given in Table 6.
Table 6. Reliability Coefficients for Auditory Achievement Tests in French, German, and Spanish—Main Study

<table>
<thead>
<tr>
<th>Achievement Test</th>
<th>Reliability</th>
<th>No. of Items</th>
<th>No. of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>.76</td>
<td>66</td>
<td>13</td>
</tr>
<tr>
<td>German</td>
<td>.79</td>
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<tr>
<td>Spanish</td>
<td>.86</td>
<td>64</td>
<td>20</td>
</tr>
</tbody>
</table>

Null Hypotheses

Phase I

Phase I of the study posed research questions relating auditory foreign language aptitude, musical aptitude and experience, auditory syllable discrimination, prior academic achievement, and the categorical variables of sex and handedness. Three null hypotheses were subjected to statistical analysis.

Correlational and Predictive Properties

\( H_0 \) I-1 There will be no significant first-order correlations among measures of auditory foreign language aptitude, musical aptitude and experience, auditory syllable discrimination, and prior academic achievement.

\( H_0 \) I-2 There will be no significant canonical correlation between measures or sets of measures of prior academic achievement and musical aptitude and experience with measures or sets of measures of auditory foreign language perception.
Differential Properties

$H_0$ I-3 The personal attribute variables of sex and handedness will not differentiate between student performance on measures of auditory foreign language aptitude, auditory syllable discrimination, musical aptitude, musical experience, and prior academic achievement.

Phase II

Phase II of the study posed research questions relating auditory foreign language achievement to the other variables under investigation. The following null hypotheses were tested.

Correlational and Predictive Properties

$H_0$ II-1 There will be no significant first-order correlations among measures of auditory foreign language achievement, foreign language aptitude, musical aptitude and experience, auditory syllable discrimination, and prior academic achievement.

$H_0$ II-2 There will be no canonical correlation between measures or sets of measures of auditory foreign language achievement with measures or sets of measures of auditory language aptitude, musical aptitude and experience, auditory syllable discrimination, and prior academic achievement.
**Differential Properties**

$H_0$ II-3 The categorical variables of sex and handedness will not differentiate performance on measures of auditory foreign language achievement.

Chapter III has described the procedures utilized in this research study. Included was a description of the subjects, the instruments, the pilot studies, the data collection procedures, and the hypotheses tested, stated in the null form. In Chapter IV the statistical analyses will be described and the results will be reported for each of the two phases of the study—the aptitude and the achievement phases.
CHAPTER IV

ANALYSES AND RESULTS

Introduction

This study examined relationships among selected factors considered to be possible correlates of auditory foreign language aptitude and achievement. Divided into two phases, the investigation provided information about student performance on selected measures prior to and after the study of a foreign language. Phase I investigated correlates of auditory foreign language perception prior to the study of a foreign language (n=133). In Phase II correlates of auditory foreign language achievement were examined (n=54).

In this chapter the results of the study are reported and discussed. Analyses of the data obtained in Phase I are presented in the first section of the chapter, followed by a discussion of the results of the analyses. Subsequently, the analyses of the data of Phase II are reported, followed by a discussion of the results. Section three of the chapter summarizes the discussions of Phases I and II.

Analyses of the Data: Phase I

The analyses of the data are presented in two sections: (1) correlational and predictive properties, and (2) differential properties. In each section the null hypotheses subjected to
statistical analyses are stated, the analyses are discussed, and findings relevant to the research questions posed in the study are reported.

Correlational and Predictive Properties

First-order Correlations. To investigate the first-order correlational properties of the variables under examination in Phase I, Pearson Product-Moment intercorrelations were calculated, thereby testing the first null hypothesis.

\[ H_0 \text{l-1 There will be no significant first-order correlations among measures of auditory foreign language aptitude, musical aptitude and experience, auditory syllable discrimination and prior academic achievement.} \]

The correlation matrix in Table 7 reports the results of this statistical analysis of the first correlational hypothesis. Of the 176 possible pairwise correlations, 164 achieved statistical significance (\( p < .05 \)); therefore, \( H_0 \text{l-1 was rejected.} \) As the matrix (Table 7) indicates, most correlations were highly significant (\( p < .001 \)); 12 pairwise correlations were not significant.

The significantly related pairwise correlates for the three PLAB auditory foreign language aptitude scores are ordered by significance level in Table 8. The most highly related pairwise correlate for the PLAB\(^5\) (Sound Discrimination) variable is the Syllable Discrimination ACCENT variable (\( p < .01 \)), followed by Iowa Measures and Musical Aptitude Measures.

The foreign language aptitude variable PLAB\(^5\) (Sound Discrimination) did not achieve significance with two Iowa Test variables (Usage
Table 7. Pearson Product-Moment Coefficients for the Prior Academic Achievement, Musical Experience, Musical Aptitude, Auditory Syllable Discrimination, and Auditory Foreign Language Aptitude Variables (n=133)

<table>
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<th>9</th>
<th>10</th>
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<td>1. VOCAB</td>
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<td></td>
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<td>2. READ</td>
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<td>3. SPELL</td>
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<td>4. USAGE</td>
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<td>0.796***</td>
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<td>5. LSKILLSTOT</td>
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<td>6. MUS EXPER</td>
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<td>7. WTOT</td>
<td>0.788***</td>
<td>0.803***</td>
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<td>0.823***</td>
<td>0.925***</td>
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<tr>
<td>8. MATHTOT</td>
<td>0.774***</td>
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<td>0.706***</td>
<td>0.786***</td>
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<td>9. IONA COMP</td>
<td>0.911***</td>
<td>0.924***</td>
<td>0.785***</td>
<td>0.878***</td>
<td>0.937***</td>
<td>0.832***</td>
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<td>10. CONCEPTS</td>
<td>0.795***</td>
<td>0.800***</td>
<td>0.667***</td>
<td>0.758***</td>
<td>0.807***</td>
<td>0.871***</td>
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<td>11. PROB</td>
<td>0.693***</td>
<td>0.789***</td>
<td>0.630***</td>
<td>0.747***</td>
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<td>0.745***</td>
<td>0.792***</td>
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<td>12. COMPUT</td>
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<td>0.743***</td>
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<td>0.689***</td>
<td>0.780***</td>
<td>0.688***</td>
<td>0.781***</td>
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<td>0.798***</td>
<td>0.780***</td>
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<td>13. MUS EXPER</td>
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<td>0.254**</td>
<td>0.293**</td>
<td>0.233**</td>
<td>0.255**</td>
<td>0.261**</td>
<td>0.296***</td>
<td>0.271**</td>
<td>0.230**</td>
<td>0.212**</td>
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<td>14. T^1-TONAL</td>
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<td>0.392***</td>
<td>0.508***</td>
<td>0.491***</td>
<td>0.546***</td>
<td>0.311***</td>
<td>0.403***</td>
<td>0.432***</td>
<td>0.477***</td>
<td>0.422***</td>
<td>0.380***</td>
<td>0.416***</td>
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<td>15. R^1-TEMPO</td>
<td>0.411***</td>
<td>0.407***</td>
<td>0.270**</td>
<td>0.444***</td>
<td>0.397***</td>
<td>0.359***</td>
<td>0.390***</td>
<td>0.402***</td>
<td>0.428***</td>
<td>0.412***</td>
<td>0.381***</td>
<td>0.323***</td>
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<td>16. R^2-METER</td>
<td>0.270***</td>
<td>0.284***</td>
<td>0.223**</td>
<td>0.296***</td>
<td>0.316***</td>
<td>0.239***</td>
<td>0.294***</td>
<td>0.324***</td>
<td>0.320***</td>
<td>0.339***</td>
<td>0.260***</td>
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<td>17. RHYTHMTOT</td>
<td>0.373***</td>
<td>0.379***</td>
<td>0.271**</td>
<td>0.405***</td>
<td>0.392***</td>
<td>0.328***</td>
<td>0.376***</td>
<td>0.399***</td>
<td>0.411***</td>
<td>0.413***</td>
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<td>18. S^2-SENSITIVITY</td>
<td>0.278***</td>
<td>0.245***</td>
<td>0.295**</td>
<td>0.319**</td>
<td>0.349***</td>
<td>0.352***</td>
<td>0.360***</td>
<td>0.326***</td>
<td>0.364***</td>
<td>0.275***</td>
<td>0.308***</td>
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<td>19. MAP COMP</td>
<td>0.474***</td>
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<td>0.433***</td>
<td>0.536***</td>
<td>0.556***</td>
<td>0.436***</td>
<td>0.499***</td>
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<td>20. COUNT</td>
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<td>0.465***</td>
<td>0.581***</td>
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<td>0.576***</td>
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<td>0.413***</td>
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<td>0.495***</td>
<td>0.445***</td>
<td>0.476***</td>
<td>0.493***</td>
<td>0.506***</td>
<td>0.478***</td>
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<td>22. PLAB^2</td>
<td>0.224***</td>
<td>0.169*</td>
<td>0.158</td>
<td>0.209**</td>
<td>0.207*</td>
<td>0.219**</td>
<td>0.185*</td>
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<td>23. PLAB^2</td>
<td>0.477***</td>
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<td>0.418***</td>
<td>0.326***</td>
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<td>24. PLABTOT</td>
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<td>0.362***</td>
<td>0.436***</td>
<td>0.360***</td>
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<td>0.396***</td>
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<td>0.442***</td>
<td>0.371***</td>
<td>0.360***</td>
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***Significant with statement confidence level (p<.001)  
**Significant with statement confidence level (p<.01)  
*Significant with statement confidence level (p<.05)
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<th>Variable</th>
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<tr>
<td>LSKILLSTOT</td>
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<td>WORKVIS</td>
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<td>WTOT</td>
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<tr>
<td>MATHTOT</td>
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<tr>
<td>IONA COMP</td>
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<td>CONCEPTS</td>
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<tr>
<td>PROB</td>
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<td></td>
</tr>
<tr>
<td>MUS EXPER</td>
<td>1.00</td>
<td></td>
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</tr>
<tr>
<td>T^1-ONAL</td>
<td>0.399*** 1.000</td>
<td></td>
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</tr>
<tr>
<td>R^1-TEMPO</td>
<td>0.271*** 0.531*** 1.000</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>R^2-METER</td>
<td>0.194* 0.462*** 0.635*** 1.000</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>RHYTHMTOT</td>
<td>0.255** 0.547*** 0.895*** 0.914*** 1.000</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>S^1-SENSITIV</td>
<td>0.097 0.252** 0.082 0.181* 0.148 1.000</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAP COMP</td>
<td>0.337*** 0.797*** 0.774*** 0.796*** 0.868*** 0.505*** 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COUNT</td>
<td>0.194* 0.425*** 0.350*** 0.306*** 0.362*** 0.103 0.611*** 1.000</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>ACCENT</td>
<td>0.282*** 0.562*** 0.388*** 0.473*** 0.479*** 0.267*** 0.591*** 0.395*** 1.000</td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>PLAB^1</td>
<td>0.052 0.118 0.065 0.144 0.117 0.189* 0.171* 0.123 0.251** 1.000</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PLAB^2</td>
<td>0.268*** 0.435*** 0.218** 0.281*** 0.278*** 0.229** 0.407*** 0.378*** 0.332*** 0.198* 1.000</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PLABTOT</td>
<td>0.189* 0.331*** 0.170* 0.263** 0.242* 0.266* 0.353*** 0.302*** 0.368*** 0.832*** 0.708*** 1.000</td>
<td></td>
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</tr>
</tbody>
</table>

Table 7 (continued)
Table 8. Pairwise Correlates of Auditory Foreign Language Aptitude by Significance Level

<table>
<thead>
<tr>
<th>PLAB^5 (Sound Discrimination)</th>
<th>PLAB^6 (Sound/Symbol Association)</th>
<th>PLABTOT (PLAB^5 + PLAB^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>***=p &lt; .001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.525*** LSKILLSTOT</td>
<td>0.447*** LSKILLSTOT</td>
</tr>
<tr>
<td></td>
<td>0.517*** SPELL</td>
<td>0.442*** IOWA COMP</td>
</tr>
<tr>
<td></td>
<td>0.497*** IOWA COMP</td>
<td>0.434*** SPELL</td>
</tr>
<tr>
<td></td>
<td>0.477*** VOCAB</td>
<td>0.431*** VOCAB</td>
</tr>
<tr>
<td></td>
<td>0.435*** CONCEPTS</td>
<td>0.396*** WTOT</td>
</tr>
<tr>
<td></td>
<td>0.435*** T^+-TONAL</td>
<td>0.378*** MATHTOT</td>
</tr>
<tr>
<td></td>
<td>0.435*** USAGE</td>
<td>0.371*** CONCEPTS</td>
</tr>
<tr>
<td></td>
<td>0.436*** MATHTOT</td>
<td>0.368*** ACCENT</td>
</tr>
<tr>
<td></td>
<td>0.424*** READ</td>
<td>0.362*** READ</td>
</tr>
<tr>
<td></td>
<td>0.421*** WTOT</td>
<td>0.360*** PROB</td>
</tr>
<tr>
<td></td>
<td>0.418*** PROB</td>
<td>0.360*** USAGE</td>
</tr>
<tr>
<td></td>
<td>0.407*** MAP COMP</td>
<td>0.353*** MAP COMP</td>
</tr>
<tr>
<td></td>
<td>0.378*** COUNT</td>
<td>0.337*** WORKVIS</td>
</tr>
<tr>
<td></td>
<td>0.332*** WORKVIS</td>
<td>0.331*** T^+-TONAL</td>
</tr>
<tr>
<td></td>
<td>0.326*** ACCENT</td>
<td>0.304*** COMPUT</td>
</tr>
<tr>
<td></td>
<td>0.281*** R^+-METER</td>
<td>0.302*** COUNT</td>
</tr>
<tr>
<td></td>
<td>0.268*** MUS EXPER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>** = p &lt; .01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.251** ACCENT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.224** VOCAB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.224** IOWA COMP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.209** LSKILLSTOT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.207** WORKVIS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.229** S^1-SENSITIV</td>
<td>0.266** S^1-SENSITIV</td>
</tr>
<tr>
<td></td>
<td>0.218** R^1-TEMPO</td>
<td>0.263** R^1-METER</td>
</tr>
<tr>
<td></td>
<td>0.242** RHYTHMTOT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* = p &lt; .05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.198* PLAB^6</td>
<td>0.198* PLAB^5</td>
</tr>
<tr>
<td></td>
<td>0.196* SPELL</td>
<td>0.189* MIS EXPER</td>
</tr>
<tr>
<td></td>
<td>0.189* S^1-SENSITIV</td>
<td>0.179* R^1-TEMPO</td>
</tr>
<tr>
<td></td>
<td>0.185* MATHTOT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.171* MAP COMP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.171* PROB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.169* READ</td>
<td></td>
</tr>
</tbody>
</table>
and Computation), nor with the Musical Experience variable, the Syllable Discrimination COUNT variable, nor four musical aptitude variables \((T^{1}\text{-TONAL}, R^{1}\text{-TEMPO}, R^{2}\text{-METER}, \text{RHYTHMTOT})\). The PLAB\(^5\) measure tested the ability to discriminate among three vocabulary words (boa, cabin, or friend) in the African language Ewe, which varied in meaning according to pitch and tonal differences. These words were each comprised of two syllables; thus, it is not surprising that the Syllable Discrimination Test COUNT variable is not significantly related to the PLAB\(^5\). Auditory recognition and memory for vocabulary meaning are essential to success on this measure. Although results on the PLAB\(^5\) did not correlate significantly with the musical experience variable, or the MAP \(T^{1}\text{-TONAL}, \text{MAP R}^{1}\text{-TEMPO}, \text{and MAP RHYTHMTOT}\) variables, they did, however, register a correlation with the MAP \(R^{2}\text{-METER}\) variable at the \(p < .10\) level.

The PLAB\(^6\) (Sound/Symbol Association) is highly correlated \((p < .001)\) with 18 Iowa test and musical aptitude variables. Language Skills Total, Spelling, Iowa Composite, Vocabulary, Concepts, MAP Tonal, Usage, and Mathematics Total were most significantly correlated. All of the top correlates for PLAB\(^5\) \((p < .01)\) were among the PLAB\(^6\) grouping correlates at the \(p < .001\) level. The three musical variables (Tonal, Meter and Musical Experience) in the \(p < .001\) grouping and two music variables (Sensitivity and Tempo) in the \(p < .01\) grouping for PLAB\(^6\) indicate qualitative differences in constructs that the two PLAB auditory measures are evaluating.

When the two PLAB scores are considered together in the PLABTOT, the top correlates are Language Skills Total, Iowa Composite,
Spelling, Vocabulary, Work Total and Math Total, followed by other Iowa Measures and the Musical Aptitude Composite, Musical Aptitude Tonal and Syllable Discrimination COUNT (all significant at $p < .001$). All other music variables—aptitude and experience—are significant pairwise correlates of the PLAB Total Auditory score. The results indicate that measures of English language ability, work study skills (of the language arts variety), math, and music aptitude and experience are correlates of auditory foreign language aptitude.

The MAP $S^1$-SENSITIV variable did not achieve a significant correlation with either the musical experience, MAP $R^1$-TEMPO, MAP RHYTHMTOT variables, or the Syllable Discrimination Test COUNT variable.

**Canonical Correlation Analyses.** Multiple correlational procedures were used to assess the relationship between a set of musical aptitude and prior academic achievement measures with a set of auditory foreign language perception measures. Canonical variate analysis was selected as the appropriate technique to explore this between-sets correlation, to provide information in response to the first research question in the problem statement (Phase I), and to test the second null hypothesis:

$$H_0 \text{ I-2 There will be no significant canonical correlation between measures or sets of measures of prior academic achievement and musical aptitude and experience with measures or sets of measures of auditory foreign language perception.}$$
Four separate canonical analyses were performed to test $H_0$ I-2. The two sets of variables, predictor and criterion, subjected to the first canonical analysis are shown in Figure 3.

![Figure 3. Model of Canonical Correlation Analysis 1-2 A](image)

A multivariate program CANON, authored by W. W. Cooley and R. R. Lohnes (Multivariate Data Analysis, 1971) computed all of the canonical correlations for Phase I. To determine statistical significance either the Bartlett Chi-square approximation or Rao's $F$-ratio may be used (Parry, 1984). Because the CANON program employs
the Chi-square as the test of significance, these statistics are reported for each canonical correlation in Tables 9, 11, and 13 for Phase I.

The results of the first canonical analysis appear in Table 9. The findings revealed that one canonical variate (of four possible roots or variates) was significant ($r = .79, p < .001$); therefore, Hypothesis 1-2 was rejected. The total proportion of shared variance (redundancy) explained in the right set (criterion set), given the left (predictor set), was 33%; of that, 28% was explained by the significant root.

To understand the composition of the new variate, one must examine the relationship of the new variate to the original set of variables. This information is supplied in the CANON program by the structure coefficients (Tables 10, 12, and 14). This is a reliable indicator of the nature and strength of the contribution of each variable to the new variate because it is a unitless measure that has been converted to a standardized score.

An examination of the magnitude of the structure coefficients in Table 10 indicates that the most important predictor variables (left set) defining the significant canonical variate are: 1) Iowa SPELL, 2) MAP $T^1$-TONAL and 3) Iowa MATHTOT. The criterion variables that comprise the significant canonical variate are, in order of their contribution: 1) SDT ACCENT, 2) SDT COUNT, and 3) PLAB$^6$. The PLAB$^5$ contributes little to the significant variate.
Table 9. Phase I: Canonical Analysis A

Canonical Correlations of the Musical Experience, Musical Aptitude, and Nine Selected Iowa Prior Achievement Variables with Auditory Foreign Language Aptitude and Auditory Syllable Discrimination Variables (11 Predictor Set and 4 Criterion Set Variables)

<table>
<thead>
<tr>
<th>Root Number</th>
<th>Canonical Correlation</th>
<th>Canonical R-Squared</th>
<th>Chi-Square</th>
<th>df</th>
<th>p</th>
<th>Redundancy for Criterion Set</th>
<th>Wilk's Lambda Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.7911</td>
<td>0.626</td>
<td>155.44</td>
<td>44</td>
<td>.001</td>
<td>0.282</td>
<td>0.2855</td>
</tr>
<tr>
<td>2</td>
<td>0.3813</td>
<td>0.145</td>
<td>33.54</td>
<td>30</td>
<td>NS</td>
<td>0.023</td>
<td>0.7630</td>
</tr>
<tr>
<td>3</td>
<td>0.3006</td>
<td>0.090</td>
<td>14.06</td>
<td>18</td>
<td>NS</td>
<td>0.019</td>
<td>0.8928</td>
</tr>
<tr>
<td>4</td>
<td>0.1359</td>
<td>0.018</td>
<td>2.31</td>
<td>8</td>
<td>NS</td>
<td>0.003</td>
<td>0.9815</td>
</tr>
<tr>
<td>Total</td>
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<td></td>
<td></td>
<td>0.327</td>
<td>0.9815</td>
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</tbody>
</table>

NS = Not Significant
Table 10. Phase I: Canonical Analysis A

Canonical Weights and Structure Coefficients of 11 Predictor Set and 4 Criterion Set Variables Associated with the Significant Canonical Variate (Root)

<table>
<thead>
<tr>
<th>Predictor Set (Left)</th>
<th>Criterion Set (Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Variables</td>
<td>Standardized Canonical Weights</td>
</tr>
<tr>
<td>VOCAB</td>
<td>0.099</td>
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<tr>
<td>READ</td>
<td>0.020</td>
</tr>
<tr>
<td>SPELL</td>
<td>0.340 (2)*</td>
</tr>
<tr>
<td>USAGE</td>
<td>0.078</td>
</tr>
<tr>
<td>WTOT</td>
<td>0.049</td>
</tr>
<tr>
<td>MATHTOT</td>
<td>0.116</td>
</tr>
<tr>
<td>MUS EXPER</td>
<td>0.082</td>
</tr>
<tr>
<td>T(^1) - TONAL</td>
<td>0.355 (1)</td>
</tr>
<tr>
<td>R(^2) - TEMPO</td>
<td>0.103</td>
</tr>
<tr>
<td>R(^2) - METER</td>
<td>0.299 (3)</td>
</tr>
<tr>
<td>S(^1) - SENSITIV</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*Rank order is indicated in parentheses.
Table 11. Phase I: Canonical Analysis B

Canonical Correlations of the Musical Experience, Musical Aptitude, and Six Selected Iowa Prior Achievement Variables with Auditory Foreign Language Aptitude and Auditory Syllable Discrimination Variables (14 Predictor Set and 4 Criterion Set Variables)

<table>
<thead>
<tr>
<th>Root Number</th>
<th>Canonical Correlation</th>
<th>Canonical R-Squared</th>
<th>Chi-Square</th>
<th>df</th>
<th>p</th>
<th>Redundancy for Criterion Set</th>
<th>Wilk's Lambda Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.7930</td>
<td>0.629</td>
<td>165.20</td>
<td>56</td>
<td>.001</td>
<td>0.284</td>
<td>0.2596</td>
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<td>0.4058</td>
<td>0.165</td>
<td>43.77</td>
<td>39</td>
<td>NS</td>
<td>0.026</td>
<td>0.6995</td>
</tr>
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<td>0.3629</td>
<td>0.132</td>
<td>21.74</td>
<td>24</td>
<td>NS</td>
<td>0.024</td>
<td>0.8374</td>
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<tr>
<td>4</td>
<td>0.1885</td>
<td>0.036</td>
<td>4.43</td>
<td>11</td>
<td>NS</td>
<td>0.007</td>
<td>0.9645</td>
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<tr>
<td>Total</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.341</td>
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</tbody>
</table>

NS = Not Significant
Table 12. Phase I: Canonical Analysis B

Canonical Weights and Structure Coefficients of 14 Predictor Set and 4 Criterion Set Variables Associated with the Significant Canonical Variate (Root)

<table>
<thead>
<tr>
<th>Predictor Set (Left)</th>
<th>Criterion Set (Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Original Variables</strong></td>
<td><strong>Standardized Canonical Weights</strong></td>
</tr>
<tr>
<td>VOCAB</td>
<td>0.104</td>
</tr>
<tr>
<td>READ</td>
<td>0.058</td>
</tr>
<tr>
<td>SPELL</td>
<td>0.385 (1)*</td>
</tr>
<tr>
<td>USAGE</td>
<td>0.043</td>
</tr>
<tr>
<td>WORKVIS</td>
<td>0.116</td>
</tr>
<tr>
<td>WTOT</td>
<td>0.066</td>
</tr>
<tr>
<td>CONCEPTS</td>
<td>0.100</td>
</tr>
<tr>
<td>PROB</td>
<td>0.117</td>
</tr>
<tr>
<td>COMPUT</td>
<td>0.152</td>
</tr>
<tr>
<td>MUS EXPER</td>
<td>0.071</td>
</tr>
<tr>
<td>T^1-TONAL</td>
<td>0.368 (2)</td>
</tr>
<tr>
<td>R^1-TEMPO</td>
<td>0.141</td>
</tr>
<tr>
<td>R^1-METER</td>
<td>0.336 (3)</td>
</tr>
<tr>
<td>S^1-SENSITIV</td>
<td>0.009</td>
</tr>
</tbody>
</table>

*Rank order is indicated in parentheses.
### Table 13. Phase I: Canonical Analysis C

<table>
<thead>
<tr>
<th>Root Number</th>
<th>Canonical Correlation</th>
<th>Canonical R-Squared</th>
<th>Chi-Square</th>
<th>df</th>
<th>p</th>
<th>Redundancy for Criterion Set</th>
<th>Wilk's Lambda Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.7126</td>
<td>0.508</td>
<td>112.29</td>
<td>36</td>
<td>.001</td>
<td>0.228</td>
<td>0.4072</td>
</tr>
<tr>
<td>2</td>
<td>0.3183</td>
<td>0.101</td>
<td>23.68</td>
<td>24</td>
<td>NS</td>
<td>0.017</td>
<td>0.8275</td>
</tr>
<tr>
<td>3</td>
<td>0.2527</td>
<td>0.064</td>
<td>10.32</td>
<td>14</td>
<td>NS</td>
<td>0.013</td>
<td>0.9207</td>
</tr>
<tr>
<td>4</td>
<td>0.1284</td>
<td>0.016</td>
<td>2.08</td>
<td>6</td>
<td>NS</td>
<td>0.003</td>
<td>0.9835</td>
</tr>
</tbody>
</table>

NS = Not Significant
Table 14. Phase I: Canonical Analysis C

Canonical Weights and Structure Coefficients of 9 Predictor Set and 4 Criterion Set Variables (Iowa Predictors) Associated with the Significant Canonical Variate (Root)

<table>
<thead>
<tr>
<th>Predictor Set (Left)</th>
<th>Criterion Set (Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Variables</td>
<td>Standardized</td>
</tr>
<tr>
<td></td>
<td>Canonical Weights</td>
</tr>
<tr>
<td>VOCAB</td>
<td>0.078</td>
</tr>
<tr>
<td>READ</td>
<td>0.063</td>
</tr>
<tr>
<td>SPELL</td>
<td>0.643 (1)*</td>
</tr>
<tr>
<td>USAGE</td>
<td>0.151 (3)</td>
</tr>
<tr>
<td>WORKVIS</td>
<td>0.053</td>
</tr>
<tr>
<td>WTOT</td>
<td>0.018</td>
</tr>
<tr>
<td>CONCEPTS</td>
<td>0.297 (2)</td>
</tr>
<tr>
<td>PROB</td>
<td>0.034</td>
</tr>
<tr>
<td>COMPUT</td>
<td>0.147 (4)</td>
</tr>
</tbody>
</table>

*Rank order is indicated in parentheses.
In Figure 4 the sets of variables in the second of the four Phase I canonical analyses (I-2B) are listed. This analysis examines the relationships among a subset of math measures (instead of the math total score) with the same other predictor variables used in analysis I-2A and the identical criterion variables as in analysis I-2A.

Figure 4. Model of Canonical Correlation Analysis I-2 B (Musical Experience, a Subset of Musical Aptitude, and a Subset of Nine Selected Prior Achievement Predictor Variables with a Subset of Auditory Foreign Language Aptitude and a Subset of Auditory Syllable Discrimination Criterion Variables)
The results of the second canonical analysis for Phase 1, again computed by the multivariate program CANON, indicate that one canonical variate (of four possible roots or variates) achieved significance \( r = .79, \quad p = .001 \). The total redundancy (or shared variance) extracted from the right set (criterion set), given the left (predictor set), for the Phase 1-2 B analysis was 34%, of which 28% resulted from the variance extracted by the significant root.

An examination of the magnitude of the structure coefficients in Table 12 indicates the canonical variate is defined by the left set (predictor) of variables by Iowa SPELL, MAP TONAL and Iowa USAGE, followed by Iowa CONCEPTS and Iowa VOCAB. The criterion variables that contribute to the variate, by order of importance, are Syllable ACCENT, PLAB \(^6\) (Sound/Symbol Association), and Syllable COUNT.

This second canonical analysis (B) confirms the results of analysis A, but indicates that when the Iowa Math Total is entered into analysis by its separate parts (Computation, Concepts, and Problems), the contribution of any one math variable lessens relinquishing its order of importance to Iowa Usage. The Concepts then follows the Iowa Usage variable.

Figure 5 shows the two sets of variables analyzed by the third canonical regression analysis (I-2 C). Only Iowa prior achievement variables are included as predictors.

Table 13 presents the results of analysis I-2 C and Table 14 gives the canonical weights and structure coefficients for the analysis. When only Iowa measures were entered as predictor variables with the four auditory perception criterion variables, once again significance was achieved. One significant
Figure 5. Model of Canonical Correlation Analysis I-2 C. (A Subset of Three Iowa Math and a Subset of Six Iowa Language and Word Skills Prior Achievement Predictor Variables with a Subset of Auditory Foreign Language Aptitude and a Subset of Auditory Syllable Discrimination Criterion Variables)

variate ($p < .001$) of the four possible roots, a total redundancy of 26%, was extracted from the criterion set, mostly composed of the Syllable Discrimination COUNT variable and the PLAB$^6$ (Sound/Symbol Association). The variance is being explained by a variate mostly described by SPELL.

To examine the relationships among musical aptitude and experience variables with the four auditory perception criterion variables, analysis I-2 D was performed. The model for the analysis is provided in Figure 6.
Musical aptitude and experience variables formed one significant \( p < .001 \) root with the auditory perception variables. (The results and weights and structure coefficients for Analysis I-2D are in Tables 15 and 16, respectively.)

A total redundancy (overlap of variance between the left and the right set) of 22% was extracted, of which 21% results from the significant root. The significant variate is defined basically by the musical aptitude tonal (\( T^1 \)-TONAL) and meter (\( R^2 \)-METER) variables from the predictor set and the Syllable Discrimination ACCENT and auditory foreign language Sound/Symbol Association (PLAB\(^6\)) variables from the criterion set, confirming the three previous analyses.

Each of the canonical analyses results in over 20% of the variance being explained by either Iowa achievement measures, music aptitude and experience measures or a combination thereof. Findings of analyses A, B, C and D are summarized in Table 17. The strongest relationship exists when musical aptitude and experience are included.

![Figure 6. Model of Canonical Correlation Analysis I-2D.](Image)
Table 15. Phase I: Canonical Analysis D

Canonical Correlations of The Musical Experience and a Subset of Musical 
Aptitude Predictor Variables With a Subset of Auditory Foreign Language 
Aptitude and a Subset of Auditory Syllable Discrimination Criterion 
Variables (5 Predictor Set and 4 Criterion Set Variables)

<table>
<thead>
<tr>
<th>Root Number</th>
<th>Canonical Correlation</th>
<th>Canonical R-Squared</th>
<th>Chi-Square</th>
<th>df</th>
<th>p</th>
<th>Redundancy for Criterion Set</th>
<th>Wilk's Lambda Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.6926</td>
<td>0.480</td>
<td>92.16</td>
<td>20</td>
<td>.001</td>
<td>0.205</td>
<td>0.4840</td>
</tr>
<tr>
<td>2</td>
<td>0.2269</td>
<td>0.052</td>
<td>9.18</td>
<td>12</td>
<td>NS</td>
<td>0.010</td>
<td>0.9302</td>
</tr>
<tr>
<td>3</td>
<td>0.1293</td>
<td>0.017</td>
<td>2.47</td>
<td>6</td>
<td>NS</td>
<td>0.003</td>
<td>0.9807</td>
</tr>
<tr>
<td>4</td>
<td>0.0507</td>
<td>0.003</td>
<td>0.33</td>
<td>2</td>
<td>NS</td>
<td>0.000</td>
<td>0.9974</td>
</tr>
</tbody>
</table>

NS = Not Significant
Table 16. Phase I: Canonical Analysis D

Canonical Weights and Structure Coefficients of 5 Predictor Set and 4 Criterion Set Variables Associated With the Significant Canonical Variate (Root)

<table>
<thead>
<tr>
<th>Predictor Set (Left)</th>
<th>Criterion Set (Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Variables</td>
<td>Standardized Canonical Weights</td>
</tr>
<tr>
<td>MUS EXPER</td>
<td>0.135</td>
</tr>
<tr>
<td>T1-TONAL</td>
<td>0.672 (1)*</td>
</tr>
<tr>
<td>R2-TEMPO</td>
<td>-0.026</td>
</tr>
<tr>
<td>R2-METER</td>
<td>0.365 (2)</td>
</tr>
<tr>
<td>S1-SENSITIV</td>
<td>0.167</td>
</tr>
</tbody>
</table>

*Rank order is indicated in parentheses.
Table 17. Summary of Significant Variates from Canonical Analyses Between Measures of Prior Academic Achievement and/or Musical Aptitude and Achievement with Measures of Auditory Foreign Language Perception

<table>
<thead>
<tr>
<th>Predictor Set</th>
<th>Canonical Correlation</th>
<th>Squared Canonical Correlation</th>
<th>$X^2$</th>
<th>df</th>
<th>$p$</th>
<th>Redundancy for Significant Root</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-2A 5 Musical Aptitude and Experience Measures, 6 Iowa Measures</td>
<td>0.7911</td>
<td>0.626</td>
<td>155.44</td>
<td>44</td>
<td>.001</td>
<td>0.282</td>
</tr>
<tr>
<td>I-2B 5 Musical Aptitude and Experience Measures, 9 Iowa Measures</td>
<td>0.7930</td>
<td>0.629</td>
<td>165.20</td>
<td>56</td>
<td>.001</td>
<td>0.284</td>
</tr>
<tr>
<td>I-2C 9 Iowa Measures</td>
<td>0.7126</td>
<td>0.508</td>
<td>112.29</td>
<td>36</td>
<td>.001</td>
<td>0.228</td>
</tr>
<tr>
<td>I-2D 5 Musical Aptitude and Experience Measures</td>
<td>0.6926</td>
<td>0.480</td>
<td>92.16</td>
<td>20</td>
<td>.001</td>
<td>0.205</td>
</tr>
</tbody>
</table>
with the predictor Iowa variables that utilized the total math score (Analysis I-2A). The amount of explained redundancy increases by over 5% from that explained by Iowa measures alone. To include the Iowa measures with the music measures increases the redundancy explained by music measure alone by nearly 8%.

Although the results of the canonical correlation analyses were straightforward, univariate multiple regression follow-up analyses were performed on the data. These are discussed in the following section.

**Multiple Regression Follow-up**

The strength of canonical analysis is the *collective* multivariate perspective of the existing relationships between variables, with the advantage of reducing the risk of Alpha inflation. Such error occurs with univariate techniques such as multiple regression, which was employed in this study only as a follow-up to the canonical correlational analyses. Specifically, each of the criterion variables (COUNT, ACCENT, PLAB\textsuperscript{5}, PLAB\textsuperscript{6}) was analyzed in separate stepwise regression procedures. This provides a clearer picture of how the original predictor variables function apart from other variables composing a set in the canonical analysis.

Four stepwise multiple regression procedures were conducted, using the program BMDP2R from *Biomedical Computer Programs*. The results of these analyses are presented in Tables 18, 20, 22, and 24. In addition, accompanying Tables 19, 21, 23, and 25 present tests of significance for the increments in \( R^2 \) for each variable that was entered into the regression model. These tests, computed by the researcher using the formula suggested by Kerlinger (1973, pp. 70-72), show the point at which predictive power was no longer increased in the regression model.
Table 18. Summary of Stepwise Multiple Regression Analysis of Phase I Predictor Variables with PLAB

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>Multiple $R^2$</th>
<th>$F$ (df = )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSKILLSTOT</td>
<td>.525</td>
<td>.275</td>
<td>49.76 (1,131)</td>
<td>.001</td>
</tr>
<tr>
<td>T1-TONAL</td>
<td>.554</td>
<td>.307</td>
<td>28.76 (2,130)</td>
<td></td>
</tr>
<tr>
<td>COMPUT</td>
<td>.569</td>
<td>.324</td>
<td>20.56 (3,129)</td>
<td></td>
</tr>
<tr>
<td>MATHTOT</td>
<td>.582</td>
<td>.338</td>
<td>16.35 (4,128)</td>
<td></td>
</tr>
<tr>
<td>SPELL</td>
<td>.596</td>
<td>.356</td>
<td>14.01 (5,127)</td>
<td></td>
</tr>
<tr>
<td>R2-METER</td>
<td>.603</td>
<td>.363</td>
<td>11.97 (6,126)</td>
<td></td>
</tr>
</tbody>
</table>
Table 19. Summary of Tests of Significance for Increments in Squared Multiple Correlations for PLAB

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F$ (df =) for increment in $R^2$</th>
<th>$p$ for increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSKILLSTOT</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$T^1$-TONAL</td>
<td>5.864 (1,127)</td>
<td>.05</td>
</tr>
<tr>
<td>COMPUT</td>
<td>3.143 (2,125)</td>
<td>.05</td>
</tr>
<tr>
<td>MATHTOT</td>
<td>2.601 (3,123)</td>
<td>NS</td>
</tr>
</tbody>
</table>
Table 20. Summary of Stepwise Multiple Regression Analysis of Phase I Predictor Variables with SDT COUNT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>Multiple $R^2$</th>
<th>$F$ (df = )</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPELL</td>
<td>.581</td>
<td>.338</td>
<td>66.84 (1,131)</td>
<td>.001</td>
</tr>
<tr>
<td>RHYTHMTOT</td>
<td>.619</td>
<td>.383</td>
<td>40.32 (2,130)</td>
<td></td>
</tr>
<tr>
<td>ACCENT</td>
<td>.625</td>
<td>.391</td>
<td>27.61 (3,129)</td>
<td></td>
</tr>
<tr>
<td>$S^1$-SENSITIV</td>
<td>.637</td>
<td>.406</td>
<td>17.36 (5,127)</td>
<td></td>
</tr>
<tr>
<td>LSKILLSTOT</td>
<td>.639</td>
<td>.409</td>
<td>14.51 (6,126)</td>
<td></td>
</tr>
</tbody>
</table>
Table 21. Summary of Tests of Significance for Increments in Squared Multiple Correlations for SDT COUNT

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F$ (df =) for increment in $R^2$</th>
<th>$p$ for increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPELL</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RHYTHMTOT</td>
<td>9.263 (1,127)</td>
<td>.01</td>
</tr>
<tr>
<td>ACCENT</td>
<td>1,642 (2,125)</td>
<td>NS</td>
</tr>
</tbody>
</table>
Table 22. Summary of Stepwise Multiple Regression Analysis of Phase I Predictor Variables with SDT ACCENT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>Multiple R²</th>
<th>F (df =)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPTOT</td>
<td>.591</td>
<td>.349</td>
<td>70.18 (1,131)</td>
<td>.001</td>
</tr>
<tr>
<td>MATHTOT</td>
<td>.631</td>
<td>.398</td>
<td>42.91 (2,130)</td>
<td></td>
</tr>
<tr>
<td>T1-TONAL</td>
<td>.646</td>
<td>.418</td>
<td>30.84 (3,129)</td>
<td></td>
</tr>
<tr>
<td>PLAB5</td>
<td>.660</td>
<td>.435</td>
<td>24.66 (4,128)</td>
<td></td>
</tr>
<tr>
<td>R²-METER</td>
<td>.671</td>
<td>.450</td>
<td>20.78 (5,127)</td>
<td></td>
</tr>
<tr>
<td>WORKVIS</td>
<td>.679</td>
<td>.461</td>
<td>17.93 (6,126)</td>
<td></td>
</tr>
</tbody>
</table>
Table 23. Summary of Tests of Significance for Increments in Squared Multiple Correlations for SDT ACCENT

<table>
<thead>
<tr>
<th>Variable</th>
<th>F (df =) for increment in R²</th>
<th>P for increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPTOT</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MATHTOT</td>
<td>10.43 (1,127)</td>
<td>.01</td>
</tr>
<tr>
<td>T¹-TONAL</td>
<td>4.35 (2,125)</td>
<td>.05</td>
</tr>
<tr>
<td>PLAB⁵</td>
<td>3.77 (3,123)</td>
<td>.05</td>
</tr>
<tr>
<td>R²-METER</td>
<td>3.33 (4,121)</td>
<td>.05</td>
</tr>
<tr>
<td>WORKVIS</td>
<td>2.44 (5,119)</td>
<td>.05</td>
</tr>
</tbody>
</table>
Table 24. Summary of Stepwise Multiple Regression Analysis of Phase I Predictor Variables with FLAB

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>Multiple R²</th>
<th>F (df = )</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCENT-German</td>
<td>.299</td>
<td>.090</td>
<td>12.88 (1,131)</td>
<td>.001</td>
</tr>
<tr>
<td>ACCENT-Spanish</td>
<td>.354</td>
<td>.125</td>
<td>9.30 (2,130)</td>
<td></td>
</tr>
<tr>
<td>S¹-SENSITIV</td>
<td>.372</td>
<td>.139</td>
<td>6.92 (3,129)</td>
<td></td>
</tr>
<tr>
<td>COUNT-English</td>
<td>.384</td>
<td>.147</td>
<td>5.52 (4,128)</td>
<td></td>
</tr>
<tr>
<td>COUNT-Total</td>
<td>.410</td>
<td>.168</td>
<td>5.13 (5,127)</td>
<td></td>
</tr>
<tr>
<td>VOCAB</td>
<td>.416</td>
<td>.173</td>
<td>4.40 (6,126)</td>
<td></td>
</tr>
</tbody>
</table>
Table 25. Summary of Tests of Significance for Increments in Squared Multiple Correlations for PLAB

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F$ (df =) for increment in $R^2$</th>
<th>$p$ for increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCENT-German</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ACCENT-Spanish</td>
<td>5.07 (1,127)</td>
<td>.05</td>
</tr>
<tr>
<td>$S^1$-SENSITIV</td>
<td>2.03 (2,125)</td>
<td>NS</td>
</tr>
</tbody>
</table>
None of the findings of the multiple regressions contradict the results of the canonical analyses. For the analyses of PLAB⁶ and COUNT, SPELL or LSKILLSTOT (that includes SPELL) emerged as the strongest predictor. In canonical analyses A and B, the Tonal variable closely followed the Spell variable as an important contributor; it also proved to be a strong predictor of PLAB⁶ and COUNT in the separate multiple regression analyses. Rhythm Total was the second strongest predictor for the Count variable following Spelling.

The strongest predictors of the ACCENT variable were the MAP total, the math total, and the tonal variables. These findings corroborate the results of the canonical analyses.

Only with PLAB⁵ did a different pattern emerge; this is not unexpected since PLAB⁵ did not contribute to the significant canonical roots in any of the four analyses. The variables that showed the strongest relationship to PLAB⁵ were two subdivisions of the ACCENT total variable, i.e., German Accent and Spanish Accent. Their predictive power was trivial, however, explaining only 13% of the variance collectively. Again, the multiple regression analysis confirmed the canonical analyses. These findings, along with the outcomes of the canonical analyses, suggest that PLAB⁵ was measuring something different from the three other criterion variables.

Differential Properties

Multivariate Analysis of Variance. To examine the effects of the categorical variables handedness and sex on the measures under study, multivariate analyses of variance were conducted.

\[ H_0 \quad I-3 \quad \text{The personal attribute variables of sex and handedness will not differentiate between student performance on} \]
measures of auditory foreign language aptitude, auditory syllable discrimination, musical aptitude, musical experience, and prior academic achievement.

There were three levels of the handedness variable, one of which had only six subjects, preventing the crossing of this variable with sex in a single analysis. Therefore, separate multivariate analyses of variance were performed using the program MANOVA distributed by Clyde Computing Services. These results are presented in Table 26. Once again, to avoid the risk of Alpha error, MANOVAs were performed followed by univariate analyses of variance. The univariate tests are presented in Tables 27 and 28.

**Sex.** In the analysis by sex, the multivariate root was found to be significant \(p < .001\). Means and standard deviations for variables that achieved significance are given in Tables 29 and 30. An examination of the standardized discriminate function coefficients indicated the new factor (root) to be composed mainly of the variables Work Study Skills Total, Musical Experience, Usage, and Vocabulary. The first three factors are performing together in a way that differs from the Vocabulary, the second most important contributor to the factor.

In other words, females who might perform well in vocabulary would demonstrate lower scores in work study skills and have less musical experience. As shown in Table 27, the only univariate tests to achieve significance were Musical Experience \(p < .01\) and Musical Sensitivity \(p < .04\). Females performed higher than males on both variables. The respective means and standard deviations are in Table 29.
Table 26. One-Factor MANOVAs on 18 Measures
By Sex and By Handedness

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Root</th>
<th>df HYP</th>
<th>df ERR</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (A)</td>
<td>1</td>
<td>1</td>
<td>18.00</td>
<td>114.00</td>
<td>3.04</td>
<td>.001</td>
</tr>
<tr>
<td>S/A</td>
<td>131</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>132</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handedness (A)</td>
<td>2</td>
<td>1</td>
<td>36.00</td>
<td>226.00</td>
<td>1.46</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>17.00</td>
<td>113.50</td>
<td></td>
<td>1.07</td>
<td>.39</td>
</tr>
<tr>
<td>S/A</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>132</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 27. Univariate ANOVAs for 18 Variables By Sex

<table>
<thead>
<tr>
<th>Variable</th>
<th>F (1,131)</th>
<th>$x^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOCAB</td>
<td>1.450</td>
<td>930.783</td>
<td>.231</td>
</tr>
<tr>
<td>READ</td>
<td>0.282</td>
<td>166.741</td>
<td>.596</td>
</tr>
<tr>
<td>SPELL</td>
<td>0.578</td>
<td>386.847</td>
<td>.449</td>
</tr>
<tr>
<td>USAGE</td>
<td>0.198</td>
<td>147.258</td>
<td>.657</td>
</tr>
<tr>
<td>WORKVIS</td>
<td>0.537</td>
<td>406.085</td>
<td>.465</td>
</tr>
<tr>
<td>WTOT</td>
<td>0.002</td>
<td>1.415</td>
<td>.968</td>
</tr>
<tr>
<td>CONCEPTS</td>
<td>1.343</td>
<td>1000.555</td>
<td>.249</td>
</tr>
<tr>
<td>PROB</td>
<td>1.025</td>
<td>700.813</td>
<td>.313</td>
</tr>
<tr>
<td>COMPUT</td>
<td>0.033</td>
<td>20.799</td>
<td>.856</td>
</tr>
<tr>
<td>MUS EXPER</td>
<td>12.951</td>
<td>113.348</td>
<td>.001***</td>
</tr>
<tr>
<td>$T^1$-TONAL</td>
<td>0.123</td>
<td>4.409</td>
<td>.726</td>
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<tr>
<td>$R^1$-TEMPO</td>
<td>0.741</td>
<td>19.361</td>
<td>.391</td>
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<td>$R^2$-METER</td>
<td>0.088</td>
<td>2.787</td>
<td>.767</td>
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<tr>
<td>$S^1$-SENSITIV</td>
<td>4.150</td>
<td>104.514</td>
<td>.044*</td>
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<tr>
<td>COUNT</td>
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<td>11.026</td>
<td>.499</td>
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<tr>
<td>ACCENT</td>
<td>0.014</td>
<td>0.687</td>
<td>.905</td>
</tr>
<tr>
<td>PLAB$^5$</td>
<td>0.278</td>
<td>4.902</td>
<td>.599</td>
</tr>
<tr>
<td>PLAB$^6$</td>
<td>2.501</td>
<td>26.764</td>
<td>.116</td>
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*** = $p < .001$

** = $p < .01$
Table 28. Univariate ANOVAs for 18 Variables By Handedness

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F$ (1,131)</th>
<th>$x^2$</th>
<th>$p$</th>
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<tbody>
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<td>VOCAB</td>
<td>2.014</td>
<td>1277.519</td>
<td>.138</td>
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<tr>
<td>READ</td>
<td>1.062</td>
<td>623.068</td>
<td>.349</td>
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<td>SPELL</td>
<td>4.897</td>
<td>3086.213</td>
<td>.009**</td>
</tr>
<tr>
<td>USAGE</td>
<td>2.039</td>
<td>1485.839</td>
<td>.134</td>
</tr>
<tr>
<td>WORKVIS</td>
<td>1.285</td>
<td>963.740</td>
<td>.280</td>
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<tr>
<td>WTOT</td>
<td>2.344</td>
<td>1583.552</td>
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<td>CONCEPTS</td>
<td>1.136</td>
<td>847.096</td>
<td>.324</td>
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<td>1.180</td>
<td>804.859</td>
<td>.311</td>
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<td>COMPUT</td>
<td>3.822</td>
<td>2285.242</td>
<td>.024*</td>
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<tr>
<td>MUS EXPER</td>
<td>0.692</td>
<td>6.639</td>
<td>.502</td>
</tr>
<tr>
<td>T$^{1}$-TONAL</td>
<td>4.206</td>
<td>142.550</td>
<td>.017*</td>
</tr>
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<td>R$^{1}$-TEMPO</td>
<td>1.744</td>
<td>44.969</td>
<td>.179</td>
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<td>R$^{2}$-METER</td>
<td>0.747</td>
<td>23.631</td>
<td>.476</td>
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<td>S$^{1}$-SENSITIV</td>
<td>0.111</td>
<td>2.909</td>
<td>.895</td>
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<tr>
<td>COUNT</td>
<td>0.115</td>
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<td>.892</td>
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<tr>
<td>ACCENT</td>
<td>1.825</td>
<td>85.023</td>
<td>.165</td>
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<tr>
<td>PLAB$^5$</td>
<td>0.843</td>
<td>14.824</td>
<td>.433</td>
</tr>
<tr>
<td>PLAB$^6$</td>
<td>0.090</td>
<td>0.985</td>
<td>.914</td>
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** $p < .01$  
* $p < .05$
Table 29. Means and Standard Deviations for Musical Experience and Sensitivity by Sex

<table>
<thead>
<tr>
<th>Gender</th>
<th>Musical Experience Mean (x)</th>
<th>Musical Experience SD</th>
<th>Sensitivity Mean (x)</th>
<th>Sensitivity SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>1.587</td>
<td>2.584</td>
<td>17.040</td>
<td>5.527</td>
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<tr>
<td>(n=75)</td>
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<td></td>
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<tr>
<td>Females</td>
<td>3.448</td>
<td>3.383</td>
<td>18.828</td>
<td>4.268</td>
</tr>
<tr>
<td>(n=58)</td>
<td></td>
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</table>
Table 30. Means and Standard Deviations for Spelling, Computations, and Tonal by Handedness

<table>
<thead>
<tr>
<th></th>
<th>Spelling</th>
<th>Computation</th>
<th>Tonal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{x} )</td>
<td>SD</td>
<td>( \bar{x} )</td>
</tr>
<tr>
<td>Right (n=100)</td>
<td>58.870</td>
<td>23.048</td>
<td>65.320</td>
</tr>
<tr>
<td>Left (n=6)</td>
<td>33.500</td>
<td>17.306</td>
<td>43.000</td>
</tr>
<tr>
<td>Either</td>
<td>46.593</td>
<td>32.728</td>
<td>55.037</td>
</tr>
</tbody>
</table>
Handedness. With regard to the Handedness variable, one significant multivariate root ($p < .05$) was also achieved. This new variate was composed of Spelling, Reading, and Concepts. The multivariate root was composed of skills that functioned in opposite directions, i.e., the students performing high in spelling skills would perform low on the measures of reading and concepts.

Univariately, Spelling by handedness was also significant ($p < .009$), as was Computations by handedness ($p < .02$) and Tonal ($p < .02$) by handedness. Right-handed students performed at a higher level than other students, followed by either-handed, then left-handed students. Means and standard deviations for these three variables by handedness are shown in Table 30.

Summary

Sex and handedness do appear to make a difference with the Iowa Achievement Variables of Spelling, Reading, Usage, Computations, and Concepts. With respect to the music aptitude measures, Tonal and Sensitivity were affected by handedness and sex, respectively, and males and females did differ in terms of Musical Experience. No differences were found in terms of auditory foreign language aptitude (PLAB$^5$ and PLAB$^6$) and syllable discrimination (SDT COUNT and ACCENT).

Analysis of the Data: Phase II

For the Phase II analysis all of the original 145 subjects who were in second level French, German, or Spanish were potential subjects. Complete data for 54 subjects were analyzed including 14 French students, 20 German students, and 20 Spanish students. The
analyses of the data are presented in two sections: (1) correlational and predictive properties, and (2) differential properties.

**Correlational and Predictive Properties**

**First-Order Correlations.** To investigate the first-order correlational properties of the variables under examination in Phase II, Pearson Product-Moment intercorrelations were calculated, thereby testing the null hypothesis:

\[ H_0^{II-1} \] There will be no significant first-order correlations among measures of auditory foreign language achievement, foreign language aptitude, musical aptitude and experience, auditory syllable discrimination, and prior academic achievement.

As Table 31 indicates, because approximately one-half of the first-order correlations for variables under study in Phase II (n=54) were significant, \( H_0^{II-1} \) was rejected. An examination of the significant intercorrelations reveals a rather consistent pattern. The variables that emerge most often in correlation with the Iowa achievement measures were COUNT, ACCENT, PLAB\(^6\), \( R^{-1}\)TEMPO, RTOT, and the MAP composite. In addition, the \( R^2\)-METER and \( R^1\)-TEMPO correlated significantly with VOCAB and READ, and \( R^2\)-METER also was significantly correlated with LSKILLSTOT (Language Skills), the variable that encompasses spelling. Spelling and Concepts were the only two Iowa achievement variables that showed significant relationships with the auditory foreign language achievement variables. (For further examination, these foreign language achievement variables and their correlates can be found in Table 32.)
Table 31. Pearson Product-Moment Coefficients for the Prior Academic Achievement, Musical Experience, Musical Aptitude, Auditory Syllable Discrimination, Auditory Foreign Language Aptitude Variables, and Auditory Foreign Language Achievement Variables (n=54)

<table>
<thead>
<tr>
<th>Variable</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>
</tr>
</thead>
<tbody>
<tr>
<td>1. VOCAB</td>
<td>1.000</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>2. READ</td>
<td>0.757***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. SPELL</td>
<td>0.632***</td>
<td>0.592***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. USAGE</td>
<td>0.603***</td>
<td>0.700***</td>
<td>0.584***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. LSILLSOT</td>
<td>0.694***</td>
<td>0.728***</td>
<td>0.852***</td>
<td>0.824***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. WORKVIS</td>
<td>0.663***</td>
<td>0.672***</td>
<td>0.517***</td>
<td>0.600***</td>
<td>0.691***</td>
<td>1.000</td>
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<tr>
<td>7. WTOT</td>
<td>0.707***</td>
<td>0.741***</td>
<td>0.651***</td>
<td>0.725***</td>
<td>0.797***</td>
<td>0.918***</td>
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<tr>
<td>8. MATHTOT</td>
<td>0.700***</td>
<td>0.730***</td>
<td>0.711***</td>
<td>0.744***</td>
<td>0.793***</td>
<td>0.682***</td>
<td>0.808***</td>
<td>1.000</td>
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<tr>
<td>9. IOWA COMP</td>
<td>0.866***</td>
<td>0.889***</td>
<td>0.765***</td>
<td>0.812***</td>
<td>0.899***</td>
<td>0.811***</td>
<td>0.906***</td>
<td>0.894***</td>
<td>1.000</td>
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<tr>
<td>10. CONCEPTS</td>
<td>0.704***</td>
<td>0.694***</td>
<td>0.657***</td>
<td>0.658***</td>
<td>0.718***</td>
<td>0.673***</td>
<td>0.751***</td>
<td>0.928***</td>
<td>0.844***</td>
</tr>
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<td>11. PROB</td>
<td>0.615***</td>
<td>0.642***</td>
<td>0.640***</td>
<td>0.742***</td>
<td>0.763***</td>
<td>0.614***</td>
<td>0.760***</td>
<td>0.935***</td>
<td>0.825***</td>
</tr>
<tr>
<td>12. COMPUT</td>
<td>0.583***</td>
<td>0.672***</td>
<td>0.656***</td>
<td>0.604***</td>
<td>0.680***</td>
<td>0.575***</td>
<td>0.701***</td>
<td>0.871***</td>
<td>0.773***</td>
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<td>13. MUS EXPR</td>
<td>0.134</td>
<td>0.284*</td>
<td>0.197</td>
<td>0.092</td>
<td>0.239</td>
<td>0.065</td>
<td>0.051</td>
<td>0.111</td>
<td>0.179</td>
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<tr>
<td>14. T^T-TONAL</td>
<td>0.220</td>
<td>0.154</td>
<td>0.187</td>
<td>0.118</td>
<td>0.226</td>
<td>0.225</td>
<td>0.254</td>
<td>0.203</td>
<td>0.231</td>
</tr>
<tr>
<td>15. R^T-TEMPO</td>
<td>0.302*</td>
<td>0.338**</td>
<td>0.133</td>
<td>0.160</td>
<td>0.231</td>
<td>0.313*</td>
<td>0.273*</td>
<td>0.210</td>
<td>0.314*</td>
</tr>
<tr>
<td>16. R^T-METER</td>
<td>0.209</td>
<td>0.273*</td>
<td>0.204</td>
<td>0.214</td>
<td>0.262</td>
<td>0.180</td>
<td>0.183</td>
<td>0.212</td>
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<tr>
<td>17. RHYTHTOT</td>
<td>0.276*</td>
<td>0.335**</td>
<td>0.194</td>
<td>0.213</td>
<td>0.277*</td>
<td>0.264*</td>
<td>0.247</td>
<td>0.235</td>
<td>0.313*</td>
</tr>
<tr>
<td>18. S^L-SENSITIV</td>
<td>-0.0511</td>
<td>0.078</td>
<td>-0.056</td>
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<td>19. MAP COMP</td>
<td>0.238</td>
<td>0.289*</td>
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<td>0.256</td>
<td>0.279*</td>
<td>0.276*</td>
<td>0.283*</td>
<td>0.245</td>
<td>0.304*</td>
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<tr>
<td>20. COUNT</td>
<td>0.462***</td>
<td>0.461***</td>
<td>0.543***</td>
<td>0.299*</td>
<td>0.459***</td>
<td>0.338***</td>
<td>0.390**</td>
<td>0.403**</td>
<td>0.497***</td>
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<td>21. ACCENT</td>
<td>0.325*</td>
<td>0.350**</td>
<td>0.411**</td>
<td>0.330**</td>
<td>0.373**</td>
<td>0.254</td>
<td>0.316*</td>
<td>0.306*</td>
<td>0.371**</td>
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<tr>
<td>22. PLAB^5</td>
<td>0.145</td>
<td>-0.074</td>
<td>-0.025</td>
<td>0.025</td>
<td>0.001</td>
<td>-0.048</td>
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<td>-0.074</td>
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<td>23. PLAB^6</td>
<td>0.383**</td>
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<td>0.314*</td>
<td>0.248</td>
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<td>24. PLABTOT</td>
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<td>25. AUD IV</td>
<td>0.136</td>
<td>0.258</td>
<td>0.243</td>
<td>0.091</td>
<td>0.163</td>
<td>0.133</td>
<td>0.192</td>
<td>0.256</td>
<td>0.231</td>
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<td>26. AUDTOT</td>
<td>0.150</td>
<td>0.193</td>
<td>0.266*</td>
<td>0.084</td>
<td>0.132</td>
<td>-0.023</td>
<td>-0.032</td>
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<td>0.135</td>
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<td>27. AUD IV+AUDTOT</td>
<td>0.161</td>
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</table>

*** Significant with statement confidence level (p<.001)
** Significant with statement confidence level (p < .01)
* Significant with statement confidence level (p < .05)
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<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
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<tr>
<td>2. READ</td>
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<tr>
<td>3. SPELL</td>
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<tr>
<td>4. USAGE</td>
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<td>5. LSKILLSTOT</td>
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<tr>
<td>6. WORKVIS</td>
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<td>7. WTOT</td>
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<td>8. MATHTOT</td>
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<td></td>
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<tr>
<td>9. IOWA COMP</td>
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<td>10. CONCEPTS</td>
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<tr>
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<tr>
<td>12. COMIUT</td>
<td>0.741***</td>
<td>0.264***</td>
<td>1.000</td>
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<td></td>
</tr>
<tr>
<td>13. MUS EXPER</td>
<td>0.158</td>
<td>0.091</td>
<td>0.082</td>
<td>1.000</td>
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<td></td>
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</tr>
<tr>
<td>14. T1-TONAL</td>
<td>0.228</td>
<td>0.145</td>
<td>0.232</td>
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<tr>
<td>15. R1-TEMPO</td>
<td>0.287*</td>
<td>0.138</td>
<td>0.140</td>
<td>0.295*</td>
<td>0.522***</td>
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<tr>
<td>16. E2-METER</td>
<td>0.258</td>
<td>0.082</td>
<td>0.268*</td>
<td>0.275*</td>
<td>0.444***</td>
<td>0.602***</td>
<td>1.000</td>
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<tr>
<td>17. RHYTHMTOT</td>
<td>0.301*</td>
<td>0.118</td>
<td>0.238</td>
<td>0.315*</td>
<td>0.532***</td>
<td>0.859***</td>
<td>0.926***</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>18. S2-SENSITIV</td>
<td>0.067</td>
<td>0.106</td>
<td>-0.031</td>
<td>-0.127</td>
<td>0.180</td>
<td>0.161</td>
<td>0.277*</td>
<td>0.254</td>
<td>1.000</td>
</tr>
<tr>
<td>19. MAP COMP</td>
<td>0.292*</td>
<td>0.160</td>
<td>0.224</td>
<td>0.342</td>
<td>0.754***</td>
<td>0.777***</td>
<td>0.825***</td>
<td>0.897***</td>
<td>0.532***</td>
</tr>
<tr>
<td>20. COUNT</td>
<td>0.428***</td>
<td>0.309**</td>
<td>0.366**</td>
<td>0.229</td>
<td>0.249</td>
<td>0.404**</td>
<td>0.278*</td>
<td>0.369**</td>
<td>0.068</td>
</tr>
<tr>
<td>21. ACCENT</td>
<td>0.343**</td>
<td>0.202</td>
<td>0.349**</td>
<td>0.322</td>
<td>0.640***</td>
<td>0.152</td>
<td>0.396**</td>
<td>0.326*</td>
<td>0.282*</td>
</tr>
<tr>
<td>22. FLAB^1</td>
<td>-0.105</td>
<td>-0.073</td>
<td>-0.019</td>
<td>-0.088</td>
<td>0.260</td>
<td>0.145</td>
<td>0.053</td>
<td>0.102</td>
<td>0.000</td>
</tr>
<tr>
<td>23. FLAB^2</td>
<td>0.311*</td>
<td>0.252</td>
<td>0.104</td>
<td>0.320</td>
<td>0.300*</td>
<td>0.138</td>
<td>0.100</td>
<td>0.130</td>
<td>-0.173</td>
</tr>
<tr>
<td>24. FLABTOT</td>
<td>0.078</td>
<td>0.069</td>
<td>0.040</td>
<td>0.099</td>
<td>0.375**</td>
<td>0.193</td>
<td>0.097</td>
<td>0.154</td>
<td>-0.092</td>
</tr>
<tr>
<td>25. AUD IV</td>
<td>0.324*</td>
<td>0.146</td>
<td>0.262</td>
<td>-0.008</td>
<td>0.196</td>
<td>0.018</td>
<td>0.100</td>
<td>0.072</td>
<td>0.117</td>
</tr>
<tr>
<td>26. AUDTOT</td>
<td>0.158</td>
<td>0.002</td>
<td>0.154</td>
<td>0.007</td>
<td>-0.212</td>
<td>-0.081</td>
<td>0.087</td>
<td>0.017</td>
<td>-0.043</td>
</tr>
<tr>
<td>27. AUD IV+AUDTOT</td>
<td>0.235</td>
<td>0.055</td>
<td>0.210</td>
<td>0.002</td>
<td>-0.229</td>
<td>-0.054</td>
<td>0.101</td>
<td>0.039</td>
<td>0.011</td>
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Table 31 (continued)

<table>
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<tr>
<th>Variable</th>
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<th>22</th>
<th>23</th>
<th>24</th>
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<th>26</th>
<th>27</th>
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<tbody>
<tr>
<td>1. VOCAB</td>
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<tr>
<td>2. READ</td>
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<tr>
<td>3. SPELL</td>
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<td>4. USAGE</td>
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<tr>
<td>5. LSKILLTOT</td>
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<tr>
<td>6. WORKVIS</td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>7. WTOT</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>8. MATHTOT</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9. IOWA COMP</td>
<td></td>
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<tr>
<td>10. CONCEPTS</td>
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<td></td>
<td></td>
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<tr>
<td>11. PROB</td>
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<tr>
<td>12. COMPUT</td>
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<td>13. MUS EXP</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. T^1-TONAL</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. R^1-TEMPO</td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>16. R^2-METER</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>17. RHYTHMTOT</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. S^1-SENSITIV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. MAP COMP</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. COUNT</td>
<td>0.343** 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. ACCENT</td>
<td>0.439*** 0.384* 1.000</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. PLAB^5</td>
<td>0.150 0.180 0.314* 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. PLAB^6</td>
<td>0.138 0.264* 0.196 0.035 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. PLABTOT</td>
<td>0.206 0.290* 0.365** 0.846*** 0.563*** 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. AUD IV</td>
<td>0.009 0.338** 0.239 -0.111 -0.308* -0.257 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. AUDTOT</td>
<td>-0.080 0.354** 0.011 -0.068 -0.109 -0.114 0.574*** 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. AUD IV+AUDTOT</td>
<td>-0.057 0.387** 0.095 -0.091 -0.193 -0.178 0.792*** 0.955*** 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 32. Pairwise Correlates of Auditory Foreign Language Achievement by Significance Level

<table>
<thead>
<tr>
<th></th>
<th>AUD IV (Questions/Answers)</th>
<th>AUDTOT (AUD IAB + AUD II + AUD III)</th>
<th>AUD IV + AUDTOT (Total Auditory Achievement)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*** = p &lt; .001</td>
<td>AUD IV + AUDTOT</td>
<td>AUD IV</td>
<td>AUD IV</td>
</tr>
<tr>
<td></td>
<td>AUDTOT</td>
<td>AUD IV + AUDTOT</td>
<td>AUDTOT</td>
</tr>
<tr>
<td>** = p &lt; .01</td>
<td>COUNT</td>
<td>COUNT</td>
<td>COUNT</td>
</tr>
<tr>
<td>*  = p &lt; .05</td>
<td>CONCEPTS</td>
<td>SPELLING</td>
<td>SPELLING</td>
</tr>
<tr>
<td></td>
<td>PLAB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COUNT, a syllable discrimination test, was highly correlated with each of the three auditory foreign language achievement measures. PLAB^6 (Sound/Symbol Association) also correlated with AUD IV (Oral Question/Written Personal Answer). The PLAB^5 variable did not correlate significantly with auditory foreign language achievement; it only achieved a significant correlation with the PLAB total score.

Canonical Correlation Analyses. Multiple correlation procedures using the subprogram CANCORR of the Statistical Analysis System (SAS) were used to assess the relationships between the variables under study in Phase II with a set of auditory foreign language achievement criterion variables. Stated in the null form, the hypothesis tested is:

\[ H_0^{II-2} \text{ There will be no canonical correlation between measures or sets of measures of auditory foreign language achievement with measures or sets of measures of auditory language aptitude, musical aptitude and experience, auditory syllable discrimination, and prior academic achievement.} \]

In this second phase of the study, the number of variables was greatly reduced in the canonical correlation and MANOVA analyses due to the small sample size. (A common practice is to provide eight subjects per variable when using these techniques.) The smaller sample size, however, would only make it more difficult to achieve significance resulting in Beta error rather than the more serious Alpha error. This is a more conservative approach to analyzing the data. The model for this analysis is found in Figure 7.
Figure 7. Model of Canonical Correlation Analysis: Phase II

The CANCORR program (SAS) analyzes the data furnishing a Rao's $F$ statistic, as opposed to the Chi Square given by the CANON program used to analyze the data of Phase I. The Standardized Canonical Coefficients in the SAS program are comparable to the structure coefficients rendered by CANON. The results of the Phase II analyses are given in Table 33. These results show that one of the two possible roots was significant ($p < .007$); therefore, $H_0^{II-2}$ was rejected. Table 34 explains the composition of the new variates. As apparent in Table 34, the original variables that contribute the most to the new variate are the PLAB total variable, COUNT, and ACCENT, the first of which contributes in a different manner from the two syllable discrimination variables. The Iowa composite, Musical Experience, and MAP composite variables have very little predictive value with respect to the new criterion variate, which is composed mostly of AUDITORY IV (Oral Question/Written Personal Answer). To better understand these results stepwise multiple regression analyses were run for each of the two criterion variables. These results are in Tables 35 and 36.
Table 33. Phase II: Canonical Analysis

Canonical Correlation of a Set of 6 Predictor Variables With a Set of 2 Auditory Foreign Language Achievement Variables

<table>
<thead>
<tr>
<th>Root Number</th>
<th>Canonical Correlation</th>
<th>Canonical R-Squared</th>
<th>Rao's F-Statistic</th>
<th>df</th>
<th>p</th>
<th>Redundancy for Criterion Set</th>
<th>Wilk's Lambda Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5956</td>
<td>0.3547</td>
<td>2.5088</td>
<td>12</td>
<td>0.007</td>
<td>0.2453</td>
<td>0.5677</td>
</tr>
<tr>
<td>2</td>
<td>0.3468</td>
<td>0.1203</td>
<td>1.2849</td>
<td>5</td>
<td>0.286</td>
<td>0.0371</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.2824</td>
<td></td>
</tr>
</tbody>
</table>
Table 34. Phase II

Standardized Canonical Coefficients for 6 Predictor Set and 2 Criterion Set Variables Associated With the Significant Canonical Variate

<table>
<thead>
<tr>
<th>Predictor Set (Left)</th>
<th>Criterion Set (Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Original Variables</strong></td>
<td><strong>Standardized Canonical Variables Coefficients</strong>*</td>
</tr>
<tr>
<td><strong>MUS EXPER</strong></td>
<td>-0.188</td>
</tr>
<tr>
<td><strong>IOWA COMP</strong></td>
<td>0.100</td>
</tr>
<tr>
<td><strong>MAP COMP</strong></td>
<td>-0.299</td>
</tr>
<tr>
<td><strong>PLABTOT</strong></td>
<td>-0.752 (1)</td>
</tr>
<tr>
<td><strong>COUNT</strong></td>
<td>0.695 (2)</td>
</tr>
<tr>
<td><strong>ACCENT</strong></td>
<td>0.576 (3)</td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>0.957</td>
</tr>
<tr>
<td><strong>AUDTOT</strong></td>
<td>0.073</td>
</tr>
</tbody>
</table>

*Or structure coefficients in CANON program of Phase I.
Table 35. Phase II

Summary of Stepwise Multiple Regression Analysis
of 6 Predictor Variables With AUD IV*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple $R$</th>
<th>Multiple $R^2$</th>
<th>$F$ (df = )</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNT</td>
<td>0.342</td>
<td>0.117</td>
<td>6.86 (1,52)</td>
<td>.01</td>
</tr>
<tr>
<td>PLABTOT</td>
<td>0.499</td>
<td>0.249</td>
<td>8.46 (2,51)</td>
<td></td>
</tr>
<tr>
<td>ACCENT</td>
<td>0.559</td>
<td>0.312</td>
<td>7.54 (3,50)</td>
<td></td>
</tr>
</tbody>
</table>

*Entry into model set at .05 significance level.
Table 36. Phase II

Summary of Stepwise Multiple Regression Analysis of 6 Predictor Variables with AUDTOT*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>Multiple $R^2$</th>
<th>$F$ (df = )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNT</td>
<td>0.358</td>
<td>0.128</td>
<td>7.61 (1,52)</td>
<td>.008</td>
</tr>
</tbody>
</table>

*Entry into model set at .05 significance level.
Multiple Regression Follow-up

The results of the follow-up procedures were consistent with the main canonical analysis of Phase II. Once again the three variables identified in the canonical analysis as having strong predictive value were the greatest significant contributors to AUD IV. More specifically, COUNT, PLABTOT, and ACCENT together explained approximately 31% of the variance in that dependent variable (AUD IV). In the analysis of AUDTOT, an insignificant contributor to the criterion variable in the canonical analysis, only COUNT was found to lend a significant percentage of explanatory power. The Iowa Composite Musical Experience, and Musical Aptitude Profile Composite variables were not significant predictors of either criterion measure, as was true in the canonical.

Additional Findings

As mentioned previously, the results of the canonical analyses reported here represent a conservative view of the data. Several other approaches to the canonical relationships were taken utilizing more of the Iowa Achievement and Musical Aptitude Profile variables since Type I (Alpha) error was really not a danger. Surprisingly, with a small sample (n=54), and a set of 15 predictor variables, significance was achieved ($p < .007$).

Information concerning one such analysis is presented in Appendix F, including the model for the canonical analysis and two summary tables. What is noteworthy is the emergence of the MAP T–TONAL measure, the Iowa Work Study Skills Total (WTOT), the SDT ACCENT
measure, and the Sound/Symbol Association (PLAB) measure, in that order, as primary predictors of the criterion variate composed mostly of the foreign language achievement variable AUD IV (Oral Question/Written Personal Answer). The COUNT and SPELL variables are noticeable by their absence as strong contributors to the predictor set.

Differential Properties

Multivariate Analysis of Variance. To examine the effects of handedness and sex and their interaction on the measures of auditory foreign language achievement, the following null hypothesis was tested:

\[ H_{0}^{II-3} \text{ The categorical variables of sex and handedness will not differentiate performance on measures of auditory foreign language achievement.} \]

A 2 x 2 MANOVA was performed using the subprogram GLM of SAS. As indicated in Table 37 there was no significant interaction of handedness and sex, nor was there any main affect for sex; however, performance on the new multivariate measure composed of AUD IV and AUDTOT was affected significantly by handedness (\( p < .055 \)); therefore, \( H_{0}^{II-3} \) was rejected. Univariate procedures (Tables 38 and 39) also show this to be the case. Consistently, on either criterion measure, right-handed individuals surpassed left-handed. The small sample size of subjects who were not randomly selected must be remembered in any interpretation of these results.

Summary of Phases I and II

In the two phases of this study—foreign language aptitude and foreign language achievement—correlational, predictive, and
Table 37. Two-Factor MANOVA on Measures of Auditory Foreign Language Achievement by Handedness and by Sex

<table>
<thead>
<tr>
<th>Source</th>
<th>df HYP</th>
<th>df ERR</th>
<th>( F )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handedness (A)</td>
<td>1</td>
<td>50</td>
<td>3.08</td>
<td>.055</td>
</tr>
<tr>
<td>Sex (B)</td>
<td>1</td>
<td>50</td>
<td>0.85</td>
<td>.433</td>
</tr>
<tr>
<td>Handedness x Sex (AB)</td>
<td>1</td>
<td>50</td>
<td>0.13</td>
<td>.878</td>
</tr>
<tr>
<td>S/AB</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 38. Univariate ANOVA for AUD IV by Sex and by Handedness

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Partial SS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handedness (A)</td>
<td>1</td>
<td>23.4430</td>
<td>4.75</td>
<td>.044</td>
</tr>
<tr>
<td>Sex (B)</td>
<td>1</td>
<td>7.8144</td>
<td>1.22</td>
<td>.237</td>
</tr>
<tr>
<td>Handedness by Sex (AB)</td>
<td>1</td>
<td>1.3450</td>
<td>0.25</td>
<td>.622</td>
</tr>
<tr>
<td>S/AB</td>
<td>50</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Table 39. Univariate ANOVA for AUDTOT by Sex and by Handedness

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Partial SS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handedness (A)</td>
<td>1</td>
<td>118.584</td>
<td>5.20</td>
<td>.027</td>
</tr>
<tr>
<td>Sex (B)</td>
<td>1</td>
<td>27.374</td>
<td>1.20</td>
<td>.279</td>
</tr>
<tr>
<td>Handedness by Sex (AB)</td>
<td>1</td>
<td>0.433</td>
<td>0.02</td>
<td>.891</td>
</tr>
<tr>
<td>S/AB</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
differential properties of selected variables were examined. In the aptitude phase, the Iowa Language Skills measure that incorporates Spelling, the Iowa math measure, and the MAP Tonal measures appeared to have the most predictive value for three criterion variables: Syllable Discrimination Count, Accent, and Sound/Symbol Association (PLAB<sup>6</sup>).

In each of the canonical analyses performed, one multivariate root was significant; the new variate formed was composed of both Iowa achievement and musical aptitude measures. It appears that tests of musical aptitude (e.g., MAP Tonal and Meter) can be used as predictors of auditory foreign language perception with little loss in predictive power, as compared to the somewhat stronger Iowa achievement predictors (Spelling, Math Total or individual math subtests, Usage, Reading, and Vocabulary).

In the auditory foreign language achievement phase of the study (Phase II, n=54) one significant multivariate root emerged in the canonical correlation analysis. Results showed that the greatest amount of variance in the criterion set, primarily influenced by the AUD IV variable (Oral Question/Written Personal Answer), was explained through the joint contributions of PLAB Total, the SDT Count and Accent variables. The Iowa Composite, Musical Experience, and Musical Aptitude Profile variables had little predictive value. Multiple regression analyses corroborated these findings.

The analyses of differential properties of Phase I (aptitude) data revealed significant differences due to sex and handedness. The composition of each of the significant roots in two separate MANOVAs,
however, was not the same. Males and females differed significantly with respect to a new variate composed primarily of Vocabulary, Work Study Skills, and Musical Experience. The variate discriminating among the three levels of handedness reflected strong contributions from Spelling, Reading, and Concepts (math). Univariately there were significant effects by sex and by Sensitivity, a MAP subtest; for handedness, significant differences emerged for Spelling, Computations and Tonal.

In the Phase II analysis, significant differences on measures of AUDTOT and AUD IV were found only between right- and left-handed subjects. There was no significant interaction on sex and handedness, nor any significant main effects for sex. Univariate tests for both dependent variables indicated a main effect for handedness, with right-handed subjects performing at a higher level.

In Chapter IV the results of the two phases of the study have been reported, discussed, and summarized. In the final chapter an overview of the objectives, procedures, and findings of the study is provided, followed by a discussion of the strengths, limitations, and implications of the research. Areas for future studies are suggested.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The first section of this final chapter summarizes the objectives, procedures, and findings of the two Phases of this longitudinal study—the foreign language aptitude phase and the foreign language achievement phase. In the second section of the chapter strengths and limitations of the study are stated; in addition, implications of the findings are discussed. In the final section areas for further research are recommended.

Summary

Objectives

The purpose of this investigation was to identify variables that relate significantly to auditory foreign language aptitude and auditory foreign language achievement. The variables under question included prior academic achievement, musical aptitude and experience, sex, handedness, and measures of auditory foreign language perception.

Procedures

This research was conducted in the Titusville (Pennsylvania) Area School District during a 29-month period (May 1981-October 1983). The study comprised two phases—an auditory foreign language aptitude phase and an auditory foreign language achievement phase. Seventh grade students who had not yet begun the study of a foreign language
were the target population for Phase I. From late May to mid-December 1981 complete data on eight assessment instruments were collected expressly for this study from 145 students, 12 of whom were excluded from analysis because of previous study of a foreign language. Prior academic achievement data were obtained from school records for 12 Iowa test measures.

Phase II of the study included 54 of those 145 subjects who subsequently chose to study French, German, or Spanish and continued language study into the second level. Auditory foreign language achievement data were collected for 14 French students, 20 German students, and 20 Spanish students in October 1983 after one entire year of language study, followed by a six-week review.

Permission to conduct the study within normal classroom sessions was granted by the school district administrators with the full cooperation of the junior-senior high school faculty. A numerical identification code was used to ensure the confidentiality of student performance on all instruments; volunteerism did not play a role because all measures were taken during routinely scheduled classes.

Measures used in the study were either commercially available or developed by the researcher to measure the constructs of interest. The commercial instruments included two measures of auditory foreign language aptitude, four measures of musical aptitude, and the measures of prior academic achievement (obtained from records). The researcher-made instruments (an auditory syllable discrimination measure; a personal background questionnaire; and auditory achievement measures in French, German, and Spanish) were piloted prior to the main
study to assess reliabilities and to determine appropriateness of materials and procedures.

The data were analyzed on the Amdahl 470 computer at the Instruction and Research Computer Center at The Ohio State University using commercially available statistical packages. Preliminary analyses included reliability assessments of the pilot and main study instruments. Phase I and Phase II data were subjected to four analytical procedures:

1. The generation of a matrix of product-moment intercorrelations of all variables.

2. Canonical correlation analyses.

3. Step-wise multiple regression follow-up procedures for the canonical analyses.

4. MANOVA with ANOVA follow-up procedures as part of the same statistical analysis.

Findings

Phase I (n=133) of the study investigated Iowa achievement and musical aptitude measures as correlates of auditory foreign language aptitude. The results of multivariate procedures indicate that Iowa Spelling, Math Total and its individual subtests, Usage, Reading, and Vocabulary, along with the MAP Tonal and Meter variables were the greatest predictors of foreign language aptitude defined by the PLAB^6 (Sound/Symbol Association), Count, and Accent (the researcher-made Syllable Discrimination Test). Based on these results, it is reasonable to utilize the Musical Aptitude Profile measures (T^1-TONAL and R^2-METER) in conjunction with selected Iowa Achievement measures as predictors of auditory foreign language perception.
The criterion measures of Phase I discriminated between males and females, as well as among levels of the handedness variable. Specifically, males and females varied on performance on a new variate composed primarily of the Iowa measures of Work Study Total and Vocabulary, and the Musical Experience variable. Right-handed subjects differed in terms of a new variate best defined by the Iowa measures Spelling, Reading, and Concepts. The criterion variables of auditory foreign language perception (SDT COUNT, SDT ACCENT, PLAB\(^5\), and PLAB\(^6\)) did not significantly discriminate between males and females nor among the levels of handedness.

In the auditory foreign language achievement phase of the study (n=54), Phase II, the Pimsleur Language Aptitude Battery Total measure and the two Syllable Discrimination subtests Count and Accent emerged as important components of a significant multivariate root that was defined mainly by the criterion variable Auditory IV (Oral Questions/Written Personal Answers). Multiple regression follow-up procedures confirmed these results.

A supplementary canonical analysis that utilized individual scores rather than total or composite scores indicated the musical aptitude tonal variable, the work studies total variable (reading maps, graphs, tables, alphabetizing, and other library usage skills), the stressed syllable perception variable, and the auditory foreign language sound/symbol association variable as primary predictors of auditory foreign language achievement; in the canonical analysis the significant criterion variate was defined mostly by a measure of the ability to respond to an oral question with a personalized written answer.
Right-handed students were found to be advantaged over left-handed students, but there were no differences in auditory foreign language achievement detected between males and females.

**Strengths**

Several strengths of the study relate to the longitudinal nature of the research. The auditory foreign language aptitude measures, and all of the Phase I data, were given prior to the study of a foreign language, at a time when school administrators, teachers, parents, and students are typically considering what program of study a child should choose, i.e., at the end of grade seven. The longitudinal nature of the study allowed measurement of subjects during a critical stage of development in the junior high school years, and their subsequent performance on an auditory foreign language achievement test. This formative period has been observed infrequently in foreign language education research.

The foreign language achievement tests conformed with standardized proficiency guidelines for content, yet were designed specifically for the goals and objectives established by the foreign language teachers of the students who were subjects in the study. These researcher-designed materials followed a format that maximized the amount of information obtained concerning the level of auditory foreign language achievement, of the students in French, German, or Spanish, while also conforming to the constraints of a classroom testing situation and the attention span for auditory testing of secondary school students.
The choice of multivariate techniques (canonical analysis and MANOVA) permitted the emergence of new variates that would have remained uncovered through the use of univariate procedures alone. In addition, these multivariate analyses reduced the risk of Alpha error and the inflated influence of any individual variable.

Limitations

The results of this study are valid, as is true in all research, only to the extent that the instruments used were reliable and valid; although the SDT Count and Accent tests demonstrated high reliability, the researcher feels that the Accent subtest French needs refinement. The difficulty in assessing word level stress in French has recently been acknowledged by Dauer (1983), who cites Leon on that subject as well.

The generalizability of this study is also restricted by the sample size and selection. All subjects were drawn from one regional high school in a small city of rural western Pennsylvania. Although sufficient subjects were available for Phase I data collection, the number of students (n=54) who continued foreign language study in level two was reduced substantially. This small sample made it potentially more difficult to recognize trends that may in fact be present.

Finally, it was the choice of the researcher to explore foreign language auditory skills and their relationships to reading and writing skills. Therefore, only the auditory foreign language aptitude was evaluated.
Implications

The findings of this investigation have implications about the nature of the good foreign language learner and the nature of auditory foreign language aptitude, as well as pedagogical implications.

The Nature of the Learner. One useful approach to an understanding of the implications concerning the nature of the good foreign language learner is to develop a profile of a student who would be an achiever in each of the two phases. In the auditory foreign language perception phase (Phase I), a student who seemingly has a high level of auditory foreign language aptitude (i.e., achieves on the PLAB\(^5\), PLAB\(^6\), COUNT and ACCENT variables) would be either a boy or a girl who spells well, has musical aptitude ability in tonal discrimination, and has good overall math ability. This hypothetical student would also discriminate stressed syllables well, would have overall language skills (encompassing spelling, capitalization, punctuation, and the use of words), and would demonstrate musical rhythmic perception ability. Based on these data, it does not seem to be important that the student is right- or left-handed or ambidextrous as far as performance on measures of auditory foreign language perception, including aptitude, is concerned.

The profile of a good foreign language learner, one who excels in auditory foreign language achievement as measured in Phase II of this investigation, would be characterized as a right-handed student who performs well on measures of the auditory discrimination of syllables, i.e., detecting the number of syllables heard and which syllable is the stressed one. In addition, this student would achieve
in spelling, in math concepts, and in the auditory foreign language aptitude sound/symbol association.

When findings based on general tendencies are discussed in terms of individual cases, the statements must be considered as hypothetical. It follows, therefore, that individuals who do not fit this pattern could also excel at auditory foreign language skills.

Pedagogical Implications. Several pedagogical implications are apparent from the findings of this investigation. First, the use of achievement measures that require creative responses, e.g., the AUD IV measure that requested a personalized written answer to oral questions, seems to call for capabilities that differ from those evaluated through measures of only auditory perception or the reproduction of perceived information. The creative response to language places demands upon the student that seem to define differences in student achievement. It appears to be important that teachers provide opportunities for creative responses to oral stimuli in teaching and in testing student achievement.

A second pedagogical implication is related to the use of music and other rhythmic materials in the foreign language classroom as an instructional and measurement tool. There is an abundance of literature on the use of music, including folksongs, popular songs, classical music, and rhythmic chants in instruction. (A bibliography of such materials is provided after the References in this volume.) The present investigation provides support for such practices as using songs, poetry, tongue-twisters, rhythmic games, and chants. The results of this study indicate that tonal discrimination and
rhythmic discrimination contribute to auditory foreign language aptitude and perception. Although musical aptitude did not correlate with auditory foreign language achievement when composite scores were analyzed (Phase II), in the supplementary analysis of auditory foreign language achievement in which individual components of musical aptitude were entered as predictors of achievement, tonal discrimination ability emerged as the most important contributor to the correlate of auditory foreign language achievement.

The importance of spelling and the ability to perceive syllables, both the number of syllables and the syllable that receives primary accent, as predictors of auditory foreign language achievement implies the need for systematic work on such skills in the years preceding foreign language study. Both aptitude and achievement are related to the ability to spell and to hear syllables.

**Auditory Foreign Language Aptitude.** The results of this study imply the importance of auditory perception of syllables and of stressed syllables as a potential measure of auditory foreign language achievement. Admittedly, these variables need to be re-examined by other researchers; there does, however, seem to be strong evidence in the present findings to suggest that such perceptual abilities are important ones in predicting success in the auditory domain.

Secondly, the findings of this investigation support the use of the Pimsleur Language Aptitude Battery auditory measures as predictors of auditory foreign language achievement. In addition, the two auditory measures (PLAB^5 and PLAB^6) performed very differently, suggesting that they are measuring very different constructs.
Recommendations

An understanding of the relationships between neurophysiological functioning and performance in foreign language is in the infant stage. This study lends some support for the existence of a relationship between handedness preference and performance on auditory foreign language measures. Further research that incorporates this psychophysiological variable is warranted. Such a study should define handedness by incorporating family history of sinistrality for the subjects; in addition, skills other than the auditory domain should be examined.

This research corroborates the findings of several studies done in the 1960s in which a tonal factor emerged as a significant predictor of foreign language achievement, and identifies rhythm perception as an aptitude factor in need of further analysis in relationship to auditory foreign language achievement.

If future research is to examine the auditory domain, further validation of the Syllable Discrimination Tests (Count and Accent) may be a useful area to pursue. This researcher recommends that the perception of syllables, and of stressed syllables, be investigated as a potential indicator of auditory foreign language aptitude.

Late in this study, it became apparent that the factors under examination intercorrelated differently when French, German, and Spanish were examined separately; this would indicate that further research is needed to uncover potential discriminatory factors.

Although no analyses were discussed in the present study, there is evidence from the first-order correlations and canonical analyses
that were run for French (n=14), German (n=20), and Spanish (n=20) students that both musical aptitude and auditory foreign language aptitude may correlate differently by language. Because of the very small number of subjects in the achievement phase of this study, it seems inappropriate to discuss these analyses; those interested in researching auditory perception should be aware of potential variation across languages as an interesting area of study.

As pointed out previously, one of the strengths of this study was its longitudinal aspect. Further longitudinal research that incorporates regular foreign language achievement data collected over a period of two or more years would be valuable. If the same testing format were utilized, a large pool of items for each achievement subtest could be accumulated. This would permit analysis of the varied skills involved in the processing required by different test items; for example, it would be of interest to determine the relationships among the factors examined in this research in regard to the diverse test items, e.g., Visual Cues with Oral Multiple Choice Answers, Oral Questions with Oral Multiple Choice Answers, Sound/Symbol Association, Dictation, Oral Questions with Personal Written Responses.

This study provides groundwork for continued exploration of psychophysiological factors, sex, handedness, and, eventually, other aspects of cerebral functioning, which are related to auditory foreign language performance. Future research in this area may provide much needed information for the individualized approach to learning that may distinguish the curricula of the next century.
REFERENCES


BIBLIOGRAPHY OF PEDAGOGICAL USES OF MUSIC


APPENDIX A

MAIN STUDY INSTRUMENTS

I. Foreign Language Achievement Tests
   A. French Listening Test
      1. Student Copy
      2. Tape Script
   B. German Listening Test
      1. Student Copy
      2. Tape Script
   C. Spanish Listening Test
      1. Student Copy
      2. Tape Script

II. Syllable Discrimination Test
   A. Student Copy
   B. Tape Script

III. Personal Background Questionnaire
French Listening Test

Part I. Listening Comprehension

A. Oral Multiple Choice with Drawing

For each of the following pictures, you will hear three sentences. The group of sentences will be repeated. Listen to all three statements before choosing your answer. Circle the letter of the sentence that best corresponds to the picture.

Example:

You hear: a. -- b. -- c. --

You circle the correct answer c.

Now, begin!

1. a b c

2. a b c

3. a b c

4. a b c
Part I. A. (Con't)

5. a  b  c

6. a  b  c

7. a  b  c

8. a  b  c


You will hear a question and three possible answers. Circle the letter of the best answer to each question. Wait to mark your answer until all choices have been given for an item. You will hear each question and group of answers twice.

Example: a  b  c  You hear: ---?

a. ---
b. ---
c. ---

The correct answer is _____.

(Go on to the next page.)
French Listening Test, p. 3

Part I. B. (Oral Multiple Choice)

Now, begin!

1. a  b  c
2. a  b  c
3. a  b  c
4. a  b  c
5. a  b  c
6. a  b  c
7. a  b  c
8. a  b  c

Part II. Sound/Symbol Association. You will hear a word or group of words for each test item. Circle the letter of the written statement for what you hear. Each statement will be pronounced twice.

Example: a. prement  You hear ____. You circle a.
        b. prend
        c. prends

Now, begin!

1. a. voit
    b. vont
    c. vin

2. a. Jean vient.
    b. Jean revient.
    c. Je viens.

3. a. Je les ai.
    b. Je l'ai.
    c. J'en ai.

    c. J'ai des pains.

5. a. Il veut le faire.
    b. Ils veulent le faire.
    c. Ils veulent le faire?

Part III. Dictation. You will hear a short conversation in French. Write in French exactly what is said. The passage will be read three times. Listen to the first reading. Do not write. The second reading will allow you time to write. Correct your work as the passage is read a third time at normal speed.

(Go on to the next page.)
French Listening Test, p. 4

Part III. (Dictation)

Now, begin!

Marc: __________________________________________________________

______________________________________________________________

Annette: _______________________________________________________

______________________________________________________________

Marc: _________________________________________________________

______________________________________________________________

Part IV. Personal Questions. You will hear five questions in French. Answer each one in a complete French sentence. Each question will be read twice. All five questions will be reread so that you can correct your work. Now, begin!

1.

2.

3.

4.

5.

End of Test
TAPE SCRIPT
FRENCH LISTENING TEST

Part I. Listening Comprehension

A. Oral Multiple Choice with a Drawing.

For each of the following pictures, you will hear three sentences; the group of sentences will be repeated. Listen to all three statements before choosing your answer. Circle the letter of the sentence that best corresponds to the picture.

Example: You hear:  
   a. Il est trois heures et quart.  
   b. Il est quatre heures et quart.  
   c. Il est quatre heures moins le quart.  

You circle the correct answer c.

Now, begin!

1. a. Georges n'est pas si grand que Jean.  
   *b. Georges est plus grand que Jean.  
   c. Georges est aussi grand que Jean.

   b. Moi, je n'ai pas de soeurs.  
   c. Moi, je suis fils unique.

   b. En mars, il pleut et il fait mauvais.  
   c. En automne, il fait du vent et les feuilles tombent.

4. a. Mon passe-temps préféré est la photographie.  
   *b. Quand il fait beau le week-end, je fais du football avec des amis.  
   c. Nous désirons regarder des timbres français.

5. a. Il n'y a pas de vendeurs ici.  
   *b. Je préfère les petits magasins et le marché.  
   c. Je vais à une répétition ce soir.

   b. Il a de l'énergie.  
   c. Pour être ingénieur, il faut être bon en maths.

7. *a. Qu'est-ce que vous voulez boire?  
   b. Quel âge as-tu?  
   c. Choisissez-vous un disque ou une lampe?
Tape Script
French Listening Test

B. Oral Multiple Choice. Question with Choice of Responses.

You will hear a question and three possible answers. Circle the letter of the best answer to each question. Wait to mark your answer until all choices have been given for an item. You will hear each question and group of answers twice.

Example: Aimez-vous la viande?

a. Oui, surtout la salade et la soupe à l'oignon.
b. Oui, j'adore le jambon et l'agneau.
c. Oui, j'aime surtout le pain et le beurre.

You circle the correct answer b.

Now, begin!

1. Combien font onze et soixante?
   a. soixante et un
   *b. soixante et onze
   c. cinquante et un

2. Quelle saison préfères-tu?
   *a. Je préfère l'hiver parce que je peux faire du ski.
   b. On aime faire ses devoirs.
   c. Au printemps, il pleut toujours ici.

3. Comment trouves-tu le gâteau?
   a. Je la trouve formidable.
   b. Je les trouve très bons.
   *c. Je le trouve excellent.

4. A quelle heure prenez-vous l'autobus le matin pour venir à l'école?
   a. Je la prends après le petit déjeuner.
   *b. Nous le prenons vers huit heures.
   c. Vous partez toujours à cette heure-là.

5. Où allez-vous au cinéma?
   *b. Je vais au cinéma près de chez moi.
   c. Je vais au cinéma à pied.
Tape Script
French Listening Test

6. Marc et Anne, avec qui allez-vous jouer au tennis?
   c. Ils vont jouer en ville avec nous.

7. Allez-vous souvent aux matchs de football?
   *a. Oui, nous y allons chaque vendredi.
   b. Oui, nous en avons.
   c. Non, nous n’en buvons jamais.

8. Téléphones-tu à tes grands-parents souvent?
   a. Oui, je lui téléphone tous les dimanches.
   b. Oui, je les connais.
   *c. Oui, je leur téléphone souvent.

Part II. Sound/Symbol Association. You will hear a word or group of words for each test item. Circle the letter of the written statement for what you hear. Each statement will be pronounced twice.

Example: You hear prennent. You circle a.

Now, begin!

1. Vont.
2. Jean revient.
5. Ils veulent le faire? (Rising intonation for question.)

Part III. Dictation. You will hear a short conversation in French. Write in French exactly what is said. The passage will be heard three times. Listen to the first reading. Do not write. The second reading will allow you time to write. Correct your work as the passage is read a third time at normal speed.

Now, begin!

Marc: Il y a un très bon film à la télé ce soir. Veux-tu le regarder avec moi?
Tape Script
French Listening Test


Marc: D'accord. Nous pouvons étudier ensemble.

Now, write the dictation. (Leave sufficient writing time when / appears.)

Marc: Il y a / un très bon film / à la télé / ce soir. Veux-tu / le regarder / avec moi?

Annette: Non, merci. / Nous avons / un examen d'histoire / demain.

Marc: D'accord. / Nous pouvons / étudier ensemble.

Now, correct your work.

Marc: Il y a un très bon film à la télé ce soir. / Veux-tu le regarder avec moi?


Marc: D'accord. Nous pouvons étudier ensemble.

PART IV. Personal Questions. You will hear five questions in French. Answer each one in a complete French sentence. Each question will be read twice. All five questions will be reread so that you can correct your work.

1. Combien de frères et de soeurs avez-vous?
   Combien de frères et de soeurs avez-vous?

2. A quelle heure commence la classe de français?
   A quelle heure commence la classe de français?

3. Est-ce que votre famille a une petite voiture française?
   Est-ce que votre famille a une petite voiture française?

4. Quels programmes regardez-vous à la télé le lundi soir?
   Quels programmes regardez-vous à la télé le lundi soir?

5. Avec qui avez-vous parlé hier soir?
   Avec qui avez-vous parlé hier soir?
Tape Script
French Listening Test

Now, listen to all five questions again. Correct your work. (Read with short pauses for correcting time. Use normal intonation for questions, a classroom sort of speed.)

1. Combien de frères et de soeurs avez-vous?
2. A quelle heure commence la classe de français?
3. Est-ce que votre famille a une petite voiture française?
4. Quels programmes regardez-vous à la télé le lundi soir?
5. Avec qui avez-vous parlé hier soir?

(End of recording.)
Part I. Listening Comprehension

A. Oral Multiple Choice with Drawing

For each of the following pictures, you will hear three sentences in German; the group of sentences will be repeated for each number. Listen to all the statements before choosing your answer. Circle the letter of the sentence that best corresponds to the picture.

Example:

You hear: a. --
        b. --
        c. --

The choices will be repeated.

The correct answer is ___.

Now, begin!

1. a. b. c.

2. a. b. c.

3. a. b. c.

4. a. b. c.
Part I. A.

5. a. b. c.

6. a. b. c.

7. a. b. c.

8. a. b. c.


You will hear a question and three possible answers. Circle the letter of the best answer to each question. Wait to mark your answer until all choices have been given for an item. You will hear each question and group of answers twice.

Example: a b c On the tape, you hear: ---?

a. ---
b. ---
c. ---

(repeated)

The correct answer is ___.

(Go on to next page.)
German Listening Test, p. 3

Name________________________

Part I. B. (Oral Multiple Choice)

Now, begin!

1. a b c
2. a b c
3. a b c
4. a b c
5. a b c
6. a b c
7. a b c
8. a b c

Part II. Sound / Symbol Association. You will hear a word or group of words for each test item. Circle the letter of the written statement for what you hear. Each statement will be pronounced twice.

Example: a. noch       You hear ___.
       b. nach
       c. Nacht     You circle answer b.

Now, begin!

1. a. wen
   b. wann
   c. wenn
2. a. leicht
   b. Licht
   c. lacht
3. a. Gerd geht nach Hause.
   b. Gerd, geh nach Hause.
   c. Gerd geht nach Hause?
4. a. höre
   b. Höhe
   c. Hühne
5. a. Die Kirche ist schön.
   b. Die Küche ist schön.
   c. Die Kirsche ist schön.

Part III. Dictation. You will hear a short conversation in German. Write in German exactly what you hear. The passage will be read three times. Listen to the tape first. Do not write. The second reading will allow you time to write. Correct your work as the passage is read a third time at normal speed.

(Go on to the next page.)
German Listening Test, p. 4

Name __________________

Part III. (Dictation)

Karl: ____________________________________________

Fritz: ____________________________________________

Karl: ____________________________________________

Part IV. Personal Questions. You will hear five questions in German. Answer each one in a complete German sentence. You will hear each question twice. All five questions will be reread so that you can correct your work.

Now, begin!

1.

2.

3.

4.

5.

End of Test
Part I. Listening Comprehension

A. Oral Multiple Choice with a Drawing.

For each of the following pictures, you will hear three sentences in German; the group of sentences will be repeated for each number. Listen to all the statements before choosing your answer. Circle the letter of the sentence that best corresponds to the picture.

           b. Hans ist kleiner als Jürgen.
           c. Hans ist so groß wie Jürgen.

You circle the correct answer b.

Now, begin!

1. a. Es ist zwanzig vor drei.
    *b. Es ist Viertel vor drei.
    c. Es ist Viertel nach neun.

       b. Ich habe keine Schwestern.
       c. Ich bin ein Einzelkind.

3. a. Heute ist es wieder kühl und windig.
    b. Es ist nass und es regnet den ganzen Tag.
    *c. Heute Nachmittag scheint die Sonne. Es ist sehr schön.

4. a. Heute schreiben wir eine Klassenarbeit.
    b. Die Jungen gehen oft bergsteigen.
    *c. Unsere Mannschaft spielt am besten.

5. a. Um acht Uhr geht Frau Busch ins Frühstückszimmer.
    b. Frau Wirth trinkt in der Konditorei Kaffee.
    *c. Frau Meier geht immer schon sehr früh einkaufen.

6. a. Sie hat eine Reifenpanne.
    b. Er ist immer ganz fleissig.
    *c. Sie ist sehr athletisch.

7. *a. Möchten Sie etwas trinken?
    b. Das ist aber wirklich ärgerlich.
    c. Nehmen Sie eine Lampe oder einen Kugelschreiber?
Tape Script
German Listening Test

8. a. Fragt ihr die Lehrerin?
   b. Sie arbeitet in der Konditorei.
   *c. Ihre Freunde rufen sie oft an.

B. Oral Multiple Choice. Question with Choice of Responses...

You will hear a question and three possible answers. Circle the letter of the best answer to each question. Wait to mark your answer until all choices have been given for an item. You will hear each question and group of answers twice.

Example: Wieviel ist zwölf und sechzig?

   a. einundsiebzig
   b. einundsechzig
   c. zweiundsiebzig

You circle the correct answer c.

Now, begin!

1. Welchen Monat hast du gern?
   a. Ich sage, dass in April ich nicht wegfahren kann.
   c. Die Frühlingsmonate heissen der März, der April und der Mai.

2. Wie findest du den Kuchen?
   *a. Ich finde ihn wunderbar.
   b. Ich finde sie sehr gut.
   c. Ich finde es ausgezeichnet.

3. Um wieviel Uhr isst du gern Frühstück?
   a. Ich bin oft sehr müde am Morgen.
   *b. Ich esse es gern vor sieben Uhr morgens.
   c. Sie isst es gern nach zehn Uhr.

4. Nehmt ihr ein Brötchen als Mittagessen?
   *a. Ja, bitte, ich nehme ein Brötchen aber mein Freund hat keinen Hunger.
   b. Nein, danke, sie essen Brot nicht gern.
   c. Ja, bitte, wir trinken das oft zu Hause.

5. Wer bist du?
   a. Ich bin im Krankenhaus.
   *b. Ich bin der Friedrich.
   c. Ich bin glücklich.
Tape Script
German Listening Test

6. Wie gehst du heute Abend ins Kino?
   a. Ich möchte gern den neuen Amerikanischen Film "E.T." sehen.
   b. Mein Freund Jürgen fährt uns mit seinem Auto.
   c. Ich gehe um sieben Uhr.

7. Anna und Heidi, ist euer Vater krank?
   a. Ja, ihr Vater ist schon drei Wochen im Krankenhaus.
   *b. Ja, unser Vater hat Fieber und Schnupfen.
   c. Ja, sein Vater kann nicht mehr arbeiten.

8. Telefonieren Sie oft Ihre Eltern?
   *a. Ja, ich rufe sie jeden Sonntag an.
   b. Nein, du rufst ihn nur an seinem Geburtstag.
   c. Ja, ich rufe euch sehr oft an.

Part II. Sound/Symbol Association. You will hear a word or group of words for each test item. Circle the letter of the written statement for what you hear. Each statement will be pronounced twice.

Example: You hear nach_____. You circle b_____.

Now, begin!

1. wen.
2. leicht.
3. Gerd, geh nach Hause!
4. Hähne.
5. Die Kirche ist schon.

Part III. Dictation. You will hear a short conversation in German. Write in German exactly what you hear. The passage will be read three times. Listen to the first reading. Do not write. The second reading will allow you time to write. Correct your work as the passage is read a third time at normal speed.

Now, listen!

Karl: Tag, Fritz! Was machst du heute?
Tape Script
German Listening Test

Fritz: Ich muß zur Bäckerei gehen. Ich kaufe Brötchen und Apfelkuchen. Kannst du mitkommen?


Now, write the dictation!

Karl: Tag, Fritz! / Was machst du heute? /


Karl: Ich habe keine Zeit. / Meine Freundin und ich / gehen ins Cafe. /

Now, correct your work!

Karl: Tag, Fritz! Was machst du heute? /

Fritz: Ich muß zur Bäckerei gehen. / Ich kaufe Brötchen und Apfelkuchen. / Kannst du mitkommen? /

Karl: Ich habe keine Zeit. / Meine Freundin und ich gehen ins Cafe. /

Part IV. Personal Questions. You will hear five questions in German. Answer each one in a complete German sentence. You will hear each question twice. All five sentences will be reread so that you can correct your work.

Now, begin!

1. Wie viele Brüder und Schwestern hast du? /
   Wie viele Brüder und Schwestern hast du? /

2. Um wie viel Uhr stehst du morgens auf? /
   Um wie viel Uhr stehst du morgens auf? /

3. Hat deine Familie ein Auto? /
   Hat deine Familie ein Auto? /

4. Was hast du gestern abend gemacht? /
   Was hast du gestern abend gemacht? /
Tape Script
German Listening Test


Now, listen to the questions a third time as you correct your work.

1. Wie viele Brüder und Schwestern hast du? (pause)
2. Um wie viel Uhr stehst du morgens auf? (pause)
3. Hat deine Familie ein Auto? (pause)
4. Was hast du gestern abend gemacht? (pause)
5. Wohin gehst du am Wochenende? (pause)
Spanish Listening Test

Part I. Listening Comprehension

A. Oral Multiple Choice with Drawing

For each of the following pictures, you will hear three sentences. The group of sentences will be repeated for each number. Listen to all the statements before choosing your answer. Circle the letter of the sentence that best corresponds to the picture.

Example: You hear: a. --
 b. --
 c. --
The choices will be repeated.
You circle the correct answer. b.

Now, begin!

1. a b c

2. a b c

Juan Jorge

3. a b c

Padre Madre

Juan Felipe Yo Mama

4. a b c

...
Part I. A. (con't.)

5. a b c

6. a b c

7. a b c

8. a b c


You will hear a question and three possible answers. Circle the letter of the best answer to each question. Wait to mark your answer until all choices have been given for an item. You will hear each question and group of answers twice.

Example: a b c On the tape, You hear: ---?

a. --
b. --
c. --

The correct answer is ___.

(Go on to the next page.)
Part I. B (Oral Multiple Choice)

Now, begin!

1. a b c
2. a b c
3. a b c
4. a b c
5. a b c
6. a b c
7. a b c
8. a b c

Part II. Sound/Symbol Association. You will hear a word or group of words for each test item. Circle the letter of the written statement for what you hear. Each statement will be read twice.

Example: a. masa You hear — .
b. mesa You circle answer c. .
c. misa ----

Now, begin!

1. a. Carlos tiene doce sombreros.
   b. Carlos tiene doscientos sombreros.
   c. Carlos tiene diez sombreros.

2. a. Juan no oye bien.
   b. Juana no oye bien.
   c. Juan oye bien.

3. a. Ana trabaja aquí.
   b. Ana trabaja aquí mañana.
   c. Ana no trabaja mañana.

4. a. Jorge cierra la puerta.
   b. ¿Jorge cierra la puerta?
   c. Jorge, ¿cierra la puerta?

5. a. Tienen una hija y un hijo.
   b. ¿Tienen una hija y un hijo?
   c. Tiene una hija y un hijo.

Part III. Dictation. You will hear a short conversation in Spanish. Write in Spanish exactly what is said. The passage will be read three times. Listen to the first reading. Do not write. The second reading will allow you time to write. Correct your work as the passage is read the third time at normal speed.

(Go on to the next page.)
Part III. (Dictation)

Now, begin!

Miguel: _________________________________________________________

_____________________________________________________________

Pedro: _________________________________________________________

_____________________________________________________________

Miguel: _________________________________________________________

_____________________________________________________________

Pedro: _________________________________________________________

_____________________________________________________________

Part IV. Personal Questions. You will hear five questions in Spanish. Answer each one in Spanish in a complete Spanish sentence. You will hear each question twice. All five questions will be reread so that you can correct your work.

Now, begin!

1.

2.

3.

4.

5.

End of Test
Part I. Listening Comprehension

A. Oral Multiple Choice with a Drawing.

For each of the following pictures, you will hear three sentences; the group of sentences will be repeated. Listen to all three statements before choosing your answer. Circle the letter of the sentence that best corresponds to the picture.

Example: You hear:  
a. Los padres de José le escriben de Madrid.  
b. Sus amigas le hablan por teléfono a menudo.  
c. Ella trabaja en un restaurante italiano.

You circle the correct answer b.

Now, begin!

1. a. Son las cuatro y cuarto.  
   *b. Son las cuatro menos cuarto.  
   c. Son las cuatro menos cuatro.

2. a. Juan es más alto que Jorge.  
   b. Juan es tan alto como Jorge.  
   *c. Juan es menos alto que Jorge.

   b. ¿Yo? No tengo hermanos.  
   c. ¿Yo? Soy el único hijo.

4. a. Hace viento y llueve mucho en el mes de marzo.  
   b. Hace fresco en el otoño y los días son cortos.  
   *c. Hay mucho sol en el mes de mayo.

5. a. Me gusta mucho escuchar el radio.  
   b. Queremos mirar la televisión los domingos.  
   *c. Mis amigos y yo deseamos jugar al fútbol los sábados.

   *b. Las frutas y los vegetales son excelentes aquí.  
   c. No hay carne ni fruta aquí.

   b. El tiene que practicar mucho.  
   c. Tengo que estudiar mucho.
Tape Script
Spanish Listening Test

8. a. ¿Vas a dar un paseo ahora?
   b. ¿Cuántos años tienes?
   *c. ¿Qué vas a tomar?

B. Oral Multiple Choice. Question with Choice of Responses.

You will hear a question and three possible answers. Circle the letter of the best answer to each question. Wait to mark your answer until all choices have been given for an item. You will hear each question and group of answers twice.

Example: ¿Les escribes a tus abuelos a menudo?
   a. Sí, le escribo todos los domingos.
   b. Sí, los conozco muy bien.
   c. Sí, les escribo a menudo.

You circle the correct answer _c_.

Now, begin!

1. ¿Cuántos son sesenta y once?
   a. sesenta y uno
   *b. setenta y uno
   c. setenta y seis

2. ¿Qué estación prefieres?
   *a. Prefiero el invierno porque me gusta la nieve.
   b. Prefiero mirar la televisión.
   c. No tengo que escuchar el radio.

3. ¿Tienes los lápices?
   a. Sí, los tengo.
   *b. No, no los tengo.
   c. No, no lo tengo.

4. ¿Estudias la lección?
   *a. Sí, la estudio.
   b. Sí, lo estudio.
   c. No, no los estudio.

5. ¿Tomas fruta en el desayuno?
   a. Sí, tomo huevos y tocino.
   b. Sí, tomo papas fritas.
   *c. Sí, tomo una naranja.
Tape Script
Spanish Listening Test

6. ¿Dónde preparas tus lecciones?
   a. Preparo mis lecciones a las ocho de la noche.
   *b. Preparo mis lecciones en casa.
   c. No preparo mis lecciones los sábados.

7. María y Pedro, ¿con quiénes van a jugar al tenis?
   *a. Vamos a jugar con Linda y Miguel.
   b. Ellos van a jugar con nosotros.
   c. Ayer, jugamos con Linda y Miguel.

8. ¿Cómo te llamas?
   a. Bien gracias, ¿y tú?
   *b. Me llamo José.
   c. Se llama Pepita.

Part II. Sound/Symbol Association. You will hear a word or group of words for each test item. Circle the letter of the written statement for what you hear. Each statement will be pronounced twice.

Example: You hear misa. You circle c.

1. Carlos tiene doce sombreros.
2. Juan no oye bien.
3. Ana no trabaja mañana.
4. Jorge, ¿cierras la puerta?
5. ¿Tienen una hija y un hijo?

Part III. Dictation. You will hear a short conversation in Spanish. Write in Spanish exactly what is said. The passage will be heard three times. Listen to the first reading. Do not write. The second reading will allow you time to write. Correct your work as the passage is read a third time at normal speed.

Now, begin!

Miguel: Oye, Pedro. ¿Qué lengua hablan Uds en la clase de español?
Pedro: Hablamos español todos los días. No podemos hablar inglés nunca.
Miguel: ¿Dónde estudias?

Pedro: Estudio en casa y en la clase.

Now, write the dictation.

Miguel: Oye, Pedro. ¿Qué lengua hablan Uds en la clase de español?

Pedro: Hablamos español todos los días. No podemos hablar inglés nunca.

Miguel: ¿Dónde estudias?

Pedro: Estudio en casa y en la clase.

Now, correct your work.

Miguel: Oye, Pedro. Qué lengua hablan Uds en la clase de español?

Pedro: Hablamos español todos los días. No podemos hablar inglés nunca.

Miguel: ¿Dónde estudias?

Pedro: Estudio en casa y en la clase.

PART IV. Personal Questions. You will hear five questions in Spanish. Answer each one in a complete Spanish sentence. Each question will be read twice. All five questions will be reread so that you can correct your work.

1. ¿De dónde eres tú?
   ¿De dónde eres tú?

2. ¿De qué color son tus zapatos?
   ¿De qué color son tus zapatos?

3. ¿A qué hora llegas a la escuela?
   ¿A qué hora llegas a la escuela?

4. ¿Cuántas personas hay en tu familia?
   ¿Cuántas personas hay en tu familia?

5. ¿Cuántos años tienes?
   ¿Cuántos años tienes?
Tape Script
Spanish Listening Test

Now, listen to all five questions again. Correct your work.
(Read with short pauses.)

1. ¿De dónde eres tú?
2. ¿De qué color son tus zapatos?
3. ¿A qué hora llegas a la escuela?
4. ¿Cuántas personas hay en tu familia?
5. ¿Cuántos años tienes?
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| **FRENCH** | **FRENCH** |
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| c. 1 2 3 4 h. 1 2 3 4 | c. 1 2 3 4 h. 1 2 3 |
| d. 1 2 3 4 i. 1 2 3 4 | d. 1 2 3 4 i. 1 2 3 |
| e. 1 2 3 4 j. 1 2 3 4 | e. 1 2 3 4 j. 1 2 3 |

| **JAPANESE** | **JAPANESE** |
| Part I. Number of Syllables | Part II. Accented Syllable |
| a. 1 2 3 4 f. 1 2 3 4 | a. 1 2 3 4 f. 1 2 3 |
| b. 1 2 3 4 g. 1 2 3 4 | b. 1 2 3 4 g. 1 2 3 |
| c. 1 2 3 4 h. 1 2 3 4 | c. 1 2 3 4 h. 1 2 3 |
| d. 1 2 3 4 i. 1 2 3 4 | d. 1 2 3 4 i. 1 2 3 |
| e. 1 2 3 4 j. 1 2 3 4 | e. 1 2 3 4 j. 1 2 3 |

Number score ______  Accented score ______
TAPE SCRIPT
SYLLABLE DISCRIMINATION TEST

English

Part I. Number of Syllables

Listen carefully to the words I say. Circle the number that shows the correct number of syllables in each word.

Example: I say IMAGINE. You circle the number 3 because there are three syllables in the word IMAGINE.

Example: I say HELPFUL. You circle the number 2 because there are two syllables in the word HELPFUL.

Let's begin!

a. excitement  
b. spice  
c. music  
d. whispering  
e. orbit  
f. anticipate  
g. motel  
h. mechanical  
i. leaf  
j. consider

Part II. Accented Syllable

Listen carefully and circle the number that shows the accented syllable in each word I say.

Example: I say IMAGINE. You circle the number 2 because the second syllable is the most accented.

Example: I say HELPFUL. You circle the number 1 because the first syllable is more accented.

Let's begin!

a. excitement  
b. spice  
c. music  
d. whispering  
e. orbit  
f. anticipate  
g. motel  
h. mechanical  
i. leaf  
j. consider

The rest of the test will be done in four other languages: German, Spanish, French and Japanese. You will be asked to identify the number of syllables and the accented syllable in each language. This time there will not be any examples.

GET READY TO BEGIN!
Spanish

Part I. Number of Syllables

Listen carefully to the words I say in Spanish. Circle the number that shows the correct number of syllables in each word.

a. mirar  f. teléfono
b. armatoste  g. rápido
c. dos  h. par
d. gordo  i. noche
e. tortilla  j. unidad

Part II. Accented Syllable

Listen carefully and circle the number that shows the accented syllable in each word I say.

a. mirar  f. teléfono
b. armatoste  g. rápido
c. dos  h. par
d. gordo  i. noche
e. tortilla  j. unidad

German

Part I. Number of Syllables

Listen carefully to the words I say in German. Circle the number that shows the correct number of syllables in each word.

a. schnell  f. Burgermeister
b. traurig  g. Fußball
c. selbstverständlich  h. Verrat
d. nicht  i. erzählen
e. Gesellschaft  j. Nachspeise

Part II. Accented Syllable

Listen carefully and circle the number that shows the accented syllable in each word I say.

a. schnell  f. Burgermeister
b. traurig  g. Fußball
c. selbstverständlich  h. Verrat
d. nicht  i. erzählen
e. Gesellschaft  j. Nachspeise
French

Part I. Number of Syllables

Listen carefully to the words I say in French. Circle the number that shows the correct number of syllables in each word.

a. sport  f. ennuyeux
b. hardiment g. bien
c. gâteau h. sapin
d. autobus i. merci
e. individu j. égalité

Part II. Accented Syllable

Listen carefully and circle the number that shows the accented syllable in each word I say.

a. sport  f. ennuyeux
b. hardiment g. bien
c. gâteau h. sapin
d. autobus i. merci
e. individu j. égalité

Japanese

Part I. Number of Syllables

Listen carefully to the words I say in Japanese. Circle the number that shows the correct number of syllables in each word.

a. kami  f. sakuma
b. taberu  g. isu
c. mo  h. kariru
d. kawasaki i. dekakeru
e. ni  j. mado

Part II. Accented Syllable

Listen carefully and circle the number that shows the accented syllable in each word I say.

a. kami  f. sakuma
b. taberu  g. isu
c. mo  h. kariru
d. kawasaki i. dekakeru
e. ni  j. mado
PERSONAL BACKGROUND QUESTIONNAIRE

1. Name________________________________  2. Gender: Male__ Female__
   (Last)  (First)  (Middle)

3. Age____  Birthday_______________________  4. Homeroom Teacher_______
   (Month)  (Day)  (Year)

5. Is your native language English? Yes__ No__
   a. If NO, please specify your native language.
       __________________________________________________________

6. Do you understand or speak any other languages? Yes__ No__
   a. If YES, please list the language(s) and explain how you
      learned it (them).
      Examples: Spanish  I lived in Mexico with my family for
                 seven months.
                 French  We studied French in fourth grade
                          in Cleveland.

      Language                      Explanation of How Language Was Learned
      __________________________________________________________

7. What hand do you usually use for the following activities?
   a. Writing. Left___ Right___ Either___
   b. Swinging a bat. Left___ Right___ Either___
   c. Striking a match. Left___ Right___ Either___
   d. Hammering a nail. Left___ Right___ Either___
   e. Brushing your teeth. Left___ Right___ Either___

   If you want to add any information about the above items, use the
   following space: ____________________________________________

8. Participation in musical activities. Have you ever participated
   (now or in the past) in the following musical activities in your
   school or community? If YES, indicate the number of years.
   a. School chorus. Yes__ No__ If YES, number of years___
   b. School band. Yes__ No__ If YES, number of years___
   c. Church choir. Yes__ No__ If YES, number of years___
   d. Private lessons. Yes__ No__ If YES, number of years___

   If YES, what kind of lessons? ______________________________________

   e. Other musical experience. Explain__________________________________
To: Homeroom Teachers of Eighth Grade Students

From: Bettye Myer

Re: Instructions for Administering the PERSONAL BACKGROUND QUESTIONNAIRE

INSTRUCTIONS TO TEACHERS:

Please read the following instructions to your eighth grade homeroom. At the bottom of this sheet, please list any absent students and return this paper to me. Read as follows:

"In the next few minutes, we will complete the PERSONAL BACKGROUND QUESTIONNAIRE. Let's do it together so that any questions can be answered at the same time.

1. Print your name, last name first.

2. If you are a boy, put a check after MALE; if you are a girl, put a check after FEMALE.


4. Homeroom Teacher. Beside your birthday is a space for your HOMEROOM TEACHER'S name.

5. Is your native language English? Check yes or no. If your answer is no, write in your native language (the language you learned to speak first).

6. Check yes if you understand or speak another language besides your native language. Check no if you don't.
   a. If yes, write the language that you understand or speak and explain how you learned it (them). (Read examples aloud with students.)

7. What hand do you USUALLY use for the following activities? Place a check beside left, right or either for each activity.
8. Participation in musical activities. Please check YES or NO. Have you ever participated in the following musical activities? If your answer is yes, fill in the number of years or part of year in the space provided.

a. School Chorus
b. School Band
c. Church Choir
d. Private Lessons

In LETTER d, if you have taken private lessons (guitar, piano, voice, etc.) tell what kind of lessons. Then tell how many years or part of year.

In LETTER e, describe any other organized musical participation that you consider important in your musical development.

List of Absent Students:
Part I. Listening Comprehension

A. Oral Multiple Choice with Drawing
   Seven items. Each item worth 1 point. (7)

B. Oral Multiple Choice. Question with Choice of Responses
   Eight items. Each item worth 1 point. (8)

Part II. Sound/Symbol Association

Four items. Each item worth 1 point. (4)

Part III. Dictation

Thirty words. Each word is worth $\frac{1}{4}$ point.
No accent results in loss of $\frac{1}{4}$ point. Inaccuracies in spelling or capitalization result in loss of $\frac{1}{2}$ point. (15)

Part IV. Questions/Responses

Five questions. Each answer is worth two points.
1 point for meaning.
Did the answer show that the student understood the question and answered appropriately, including the tense of the verb?

1 point for grammar.
Is the grammar correctly expressed in the foreign language? Deduct $\frac{1}{2}$ point if a sentence was not used yet it is clear that the question was understood and answered appropriately. (10)

Scoring grammatical errors: total loss for grammar/sentence: 1 point, up to two $\frac{1}{2}$ point errors.
More than two errors: deduct the maximum of 1 point only.
Repeated error: deduct for the same error just once, deducting $\frac{1}{2}$ point.

Use of numerical number for word: deduct the first time. Treat as repeated error if repeated.

Award $\frac{1}{2}$ point: at times, the student demonstrates real knowledge of grammar but gave a long answer, resulting in error. Award $\frac{1}{2}$ point if you feel he/she earned it, in spite of errors elsewhere.
APPENDIX C

LETTERS TO TEACHERS INVOLVED IN DEVELOPING AND PILOTING FOREIGN LANGUAGE ACHIEVEMENT TESTS
To: Foreign Language Teachers
Titusville High School

September 16, 1983

From: Bettye Myer

Re: Rough Drafts of the French, German and Spanish Listening Achievement Tests—Request for Revisions and Corrections

Sharon, Edith, and Karla:

Here are the rough drafts of the student tests and the tape script. I have several questions and requests for suggestions.

1. Are the test items valid for your students content-wise? My test writers and I used the textbook chapters discussed with you, but only you can say "they haven't had it" with real certainty.

2. Will the students be challenged by a significant amount of the items? I don't want the test to be too easy, thereby ensuring that it will discriminate; however, I don't want the students to feel that it is too hard. I feel that the basic format is what I need.

Please make suggestions for changes, especially in Part III (Dictation) and Part IV (Personal Questions).

3. As you read through the test you will probably want to use both the student copy and instructor copy at the same time. Please select one item for an example for each of the sections of Part I.

Part I A—Example and 8 test items
(The drawings are like the rough copy I'm including.) Edith, No. 3, how do you say "only child" and do they know it?

Part I B—Example and 8 test items
German: Edith, eliminate 2 items from this part.

Part II --Sound/Symbol
French: I like the French section. Do you feel it is appropriate, Karla?

Spanish: Sharon, please eliminate one choice for each of the items, leaving three choices (two + the correct choice that is indicated). Are these too hard, Sharon? If so, please suggest something. We wanted intonation to be tested for imperative and question.
German: Edith, I'd like some sentences that discriminate like the Spanish does. Any suggestions? It's OK, I think, but not super.

Part III—Dictation
Not meant to be too hard. Maybe the French is harder than the others because it includes material more recently covered, conjugated verb + infinitive. I'd like the three tests to be as equivalent as possible.

Part IV --Personal Questions
Change them as you please, trying to encourage students to use adjectives and verbs that they have studied.

4. Please don't teach towards the test. In fact, once you've checked for content and format, I'd prefer you didn't see the test again. I do want the kids to be stretched a bit.

5. Points
Part IA  -  8 x 2  =  16
Part B  -  8 x 2  =  16
Part II -  5 x 2  =  10
Part III - 30 words  =  15
Part IV -  5 x 2  =  10

I'm pleased to have 16 pure auditory items, with no reading or writing in Part I. Items are equivalent, or nearly so in grammar and difficulty, as well as content. I'd like to have additional Sound/Symbol items to increase the possible reliability of the section.

6. I will tape next week, but will have to wait until the week of October 10 to pilot the tests. The date that you will give the exams is up to you, depending on your and the school's schedules. We have discussed avoiding days with disruptions to classes. It is important that all tests be given on the same day. To avoid the possibility that students will discuss the test content with their friends in another language, let's ask them to wait until the next day to discuss the test outside of their own class.

Thank you so much for your continued cooperation and support. I shall talk with each of you individually when I stop by the school to pick up your corrections to these drafts at the end of the week.

Thanks again,
Bettye
To: Jamestown and Southwestern
   Foreign Language Teachers

From: Bettye Myer

Re: Piloting Foreign Language Achievement Tests

Thank you very much for your willingness to pilot the tests. I would like to explain your role in the procedure being followed in my dissertation data collection.

A tape script was prepared for the textbooks for the three languages taught in the high school for the main study. The test, in rough draft form, was given to each of the three language teachers involved. Item selections, deletions, additions were made. The test was redone, taped by male native speakers in good sound studios. The first German recording was not clear and was too fast. Therefore, it was redone. The Spanish and French tapes have been played for college-level students who know too much language. But, we caught a Spanish error that has since been retaped. The French seems accurate.

The importance of the pilot is to establish reliability scores for the test. These are supposed to be done prior to the main study. Upwards of fifteen students are needed in each language.

My study involves the correlation of musical aptitude scores, foreign language aptitude scores (Pimsleur PLAB, auditory only), IOWA achievement scores and foreign language auditory achievement. This study was begun when the student subjects were at the end of seventh grade. They are now sophomores.

Now a word about procedures. On a second sheet, I have given some suggestions and explanations. Please return any corrections or comments in the envelope with the tests, tape. You may keep the script and original for student copy for your files, if you wish. It is my work, based on lots of Ohio State Romance Language Department tests and others. One of the drawings is not mine.

Thank you for playing this important part in the development of these tests.

Sincerely,

Bettye J. Myer
To: Jamestown and Southwestern
   Foreign Language Teachers

From: Bettye Myer

Re: Listening Test Explanations and Procedures

1. This test should prove a challenge for all students who studied from the textbooks on which it was prepared. Your students probably did not have the book nor the format for multiple choice in some cases. Therefore, they are disadvantaged.

2. Please advise students that they should try their best, not talk while the tape is going and to offer helpful comments after the test. Any questions might be answered by raising a hand, stopping the tape and going on afterwards.

3. Please provide feedback on the comprehensibility of the tape, clarity of test papers and general student and personal reactions.

If you have questions, I can be reached at Bear Lake (792-9258) or SUC Fredonia (673-3385).

Once again, I am indebted to you and your students.
APPENDIX D

PROCEDURES FOR ADMINISTRATION OF

MAIN STUDY INSTRUMENTS
INSTRUCTIONS FOR ADMINISTERING THE
SYLLABLE DISCRIMINATION TEST

1. Before the students enter the classroom, place the tape recorder so that everyone will be able to hear the tape recording. The front of the room is generally the best position. Thread the tape, turn the recorder on and play a small portion of the test. When the balance and volume have been adjusted, rewind the tape to the beginning and leave the recorder on.

2. The answer sheets may be placed on the desks before the students enter or distributed after the students are seated. Extra pencils should be made available in case someone breaks a pencil or does not have an eraser. It may be helpful to have the following instructions on the chalkboard:

SYLLABLE DISCRIMINATION TEST (20 minutes)

A. Please use pencil. Sharpen it before class begins, if necessary. If you need a pencil or an eraser, raise your hand.

B. Please DO NOT TALK during the test. If you have a question, raise your hand.

3. When everyone has a pencil and an answer sheet, please say the following, slowly and distinctly:

"During this class period, we will have a listening test. It will take approximately twenty minutes. Your ability to hear syllables will be tested. You will be asked to listen to words in English and in foreign languages. On your paper you will circle the number of the best response."

The students will be asked to complete the information at the top of the answer sheet. Please say slowly and distinctly:

"In the place for our name, PRINT your LAST NAME FIRST, then your first name and middle initial." (Pause.) "Put a check after M, if you are a boy. Put a check after F, if you are a girl." (Pause.) Give the name of your homeroom teacher and this class period, ________."
Instructions for Administering
the Syllable Discrimination Test

4. All the instructions for the test are on the test tape. Have the students read the instructions that are written for the English section on the answer sheet. These will be heard on tape also. Then tell them that four other similar sections will be heard in German, Spanish, French and Japanese.

"Read the instructions for the English section of the test, Parts I and II." (Pause.) "You will hear these same instructions on the tape. Are there any questions?" (Pause.) "We are ready to begin."

Turn on the tape.
DIRECTIONS FOR ADMINISTERING THE MUSICAL APTITUDE PROFILE

Preliminary directions to test administrators:

1. Before the students enter the classroom, place the tape recorder so that everyone will be able to hear the tape recording. The front of the room is generally the best position. Thread the correct tape, turn the recorder on, and play a small portion of the test. When the correct volume and balance have been obtained, rewind the tape to the beginning and leave the recorder on. To lessen listening fatigue, set the TREBLE control down and BASS control up.

2. The answer sheets may be placed on the desks before the students enter the room or distributed after the students are seated, depending upon the circumstances. Extra pencils with erasers should be made available during the test.

On the blackboard write:

MUSICAL APTITUDE PROFILE
(Ex.) T1 Tonal Imagery-Melody (name of subtest)

A. Please use pencil. Sharpen before we begin. If you need a pencil or eraser, please ask.

B. Raise your hand if your pencil breaks.

3. The students will be asked to complete the information in the lower right hand corner of page one of the answer sheet (name, school, city, state). The tests will not be machine scored; therefore, the personal information does not need to be blocked in the space provided on page two. The completion of the personal data on the sheets should take no more than five minutes. The test administrator is asked to speak slowly and distinctly.

"We are now going to begin taking the Musical Aptitude Profile, a test of musical aptitude. The information gained from taking this test may be of help to you in making plans for your musical activities now and in the future." (Pause.)

"These tests will be given in two different sessions. There are four parts. Each part is between 15 and 18 minutes long. The tests are recorded on tape."
Directions for Administering
the Musical Aptitude Profile

"Now PRINT your name in the space provided in the lower right hand corner of the answer sheet. Be sure to print your last name first, then your first name, and then your middle name or middle initial." (Pause.) "Now, on the line below, print the name of our school, TITUSVILLE JUNIOR HIGH SCHOOL." (Pause.) "Now fill in the city and state," (Pause.)
To: Foreign Language Faculty  
Titusville High School

From: Bettye Myer

Date: October 18, 1983

Re: Listening Achievement Test in French, German or Spanish  
Procedures for Test Administration

Each foreign language teacher has received an envelope containing a master copy of the test tape, a copy of the tape script, sufficient copies of the student test in each language for all level students, plus copies for your files (60 French, 60 German, 100 Spanish). The student test copies have been color coded by language (French-blue, German-gold, Spanish-green).

Please make any corrections on the tape script and/or on a copy of the student test, should you find error(s). Although the test was carefully developed, recorded, piloted, edited, and copied, there is still the possibility of corrections to be made.

The sophomores who are in French II, German II or Spanish II are the subjects of the study. Please request that the student's year in school be written above the space for his or her name; subsequently, the subjects of the study will be sorted from other students in your classes.

The following announcements seem appropriate to ensure that the exams are administered in the same way.

ANNOUNCEMENTS TO THE STUDENTS

1. Complete your name and date in the spaces provided. Above your name write 10th, 11th, or 12th, to indicate your year in school.

2. The listening test you are going to take is tape-recorded by a native speaker of (French, german, or Spanish). All the instructions are written on the test and also stated on the tape-recording. Please listen carefully. Do not talk during the test. If you have a question that the teacher needs to answer, please raise your hand without talking.

3. There are four pages. Please check now to see that you have all four pages.

4. Please do not discuss the test outside of class today with other students. Wait until tomorrow.

5. Do your best. Remember, all students should find one or two questions to be difficult.
APPENDIX E

DESCRIPTIVE WORK-UP OF PERSONAL DATA FOR TOTAL SAMPLE

December 1981

n = 145 (All subjects including those having studied a foreign language)
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<th>Descriptor</th>
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<th>n</th>
<th>%</th>
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<td></td>
<td>Females</td>
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<td><strong>Total</strong></td>
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<tr>
<td><strong>Age (December 1981)</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>3</td>
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<tr>
<td></td>
<td>13</td>
<td>99</td>
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<tr>
<td>((\bar{x} = 13.3))</td>
<td>14</td>
<td>37</td>
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<tr>
<td></td>
<td>15</td>
<td>6</td>
<td>4.1</td>
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<tr>
<td><strong>Native Language</strong></td>
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<td>99.3</td>
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<td><strong>Handedness</strong></td>
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APPENDIX F

PHASE II CANONICAL ANALYSIS FOR 15 PREDICTOR SET AND 2 CRITERION SET VARIABLES

1. Model
2. Canonical Analysis
3. Weights and Structure Coefficients
Model of Canonical Correlation Analysis for Phase II
(15 Predictor and 2 Criterion Variables)

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<tr>
<th>Mus Exper</th>
<th>Vocab</th>
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<td>T°-Tonal</td>
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<td>R°-Tempo</td>
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<tr>
<td>R²-Meter</td>
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<tr>
<td>S°-Sensitiv</td>
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<tr>
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<td>Accent</td>
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(R)
Phase II: Canonical Analysis
Canonical Correlation of a Set of 15 Predictor Variables with a Set of Auditory Foreign Language Achievement Variables

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<th>Root Number</th>
<th>Canonical Correlation</th>
<th>Canonical R-Squared</th>
<th>Rao's F Statistic</th>
<th>df</th>
<th>p</th>
<th>Redundancy for Criterion Set</th>
<th>Wilk's Lambda Prime</th>
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### Phase II

**Standardized Canonical Coefficient for 15 Predictor Set and 2 Criterion Set Variables Associated With the Significant Canonical Variate**

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<th>Criterion (Right)</th>
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<td>Standardized Canonical Variables Coefficients**</td>
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<td>READ</td>
<td>-.3045</td>
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<tr>
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<tr>
<td>USAGE</td>
<td>-.5572 (5)*</td>
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<tr>
<td>WTOT</td>
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<td>MATHTOT</td>
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*Rank order is indicated in parentheses.

** Identified as Structure Coefficients in Canon Program of Phase I