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ABSTRACT

In this thesis, the effect of a Spanish and English language-cultural environment on linguistic functioning was studied. The study was conducted in 3 adjacent coastal communities in southern California. It used 3 groups of children (30 in each group) who differed in certain identifiable aspeces of language-cultural background but who were alike in nonlanguage intelligence, chronological age, grade (7th & 8th), sex, and socioeconomic status. The 3 groups consisted of (1) Mexican American children speaking both English and Spanish upon entering kindergarten (E-S), (2) Anglo American children speaking only English upon entering kindergarten (A-E), and (3) Mexican American children who had never spoken any language but English but whose parents communicate in English and Spanish (M-E). All were compared in all areas except articulation by an analysis of covariance with nonlanguage IQ as the covariate. Differences in number of articulatory errors, among groups, were tested by means of the chi-square, the Wilcoxon Matched Pairs Signed Ranks Test, and the Duncan test, which was also used to determine which group differed from others. There were significant differences among the groups in silent reading comprehension, mechanics of English, general language development, oral reading accuracy and comprehension, articulation, and inflection. Analysis indicated that in each of these areas there were no significant differences between the A-E and M-E groups, but that both of these groups excelled the E-S group. There were no significant differences among groups in silent reading vocabulary, total silent reading, spelling, or phonemic discrimination. Included are 81 tables of data. (NQ)

A STUDY OF SEVERAL LINGUISTIC FUNCTIONS OF MEXICAN-AMERICAN CHILDREN IN A TWO-LANGUAGE ENVIRONMENT

by

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CHAPTER I

PRESENTATION OF THE PROBLEM

Introduction

Opinion differs in regard to the language development of children of foreign-language homes and who learn two languages simultaneously as they grow up. In the view of Pei (25), children who learn two languages at once are at an advantage. Languages, according to him are best learned from birth, or as close to it as possible. He cites the experience of bilingual countries such as eastern Canada, Luxembourg, Switzerland, and many border regions of Europe. The child who grows up in a bilingual atmosphere usually retains his two "native" languages for life, Pei says, and speaks, understands, reads, and writes them with equal facility.

Others, including Van Riper (40:144) believe that it is usually disastrous to teach a child two languages at once. He states that the teacher must educate parents to insist upon one language until the child has acquired a mastery of it. This seems in accordance with Niemeyer's (24) recommendation that the child from a Spanish-speaking home learn to read and write his original language before learning English.

There appears to have been relatively little research to support either view, and results have been equivocal.

It may be that in a large genuinely bilingual community, both languages with their dialectical characteristics are quite standard for the inhabitants. Thus they may communicate quite effectively among themselves. The situation may be entirely different in a California community in which there are children who have learned two languages. Here the standard language in English. School achievement depends upon the child's ability to communicate in English.

It should be recognized that retardation in language development and school achievement may not be due primarily to faulty language patterns. Parents who insist on using their original language, and talking that language to their children, may be the ones who cling to the customs and culture of the native country. Perhaps it is their resistance to acculturation, rather than the incidental presence of an

additional language, which makes school achievement difficult for the child.

In any case, problems of children who speak two languages are of extreme importance to educators in areas with large Latin-American populations. This alone justifies further research as to how their language development differs from that of children who have learned only one language. Moreover, with the current emphasis on foreign language instruction, it would seem absurd to discourage parents from teaching a child two languages simultaneously unless to do so has adverse effects.

In the review of research literature (Chapter II), the terms "monolingual" and "bilingual" are employed in keeping with the terminology of the original literature. For purposes of the present study, the term "bilingual" is avoided for two reasons.

First, to many, the term "bilingual" means that the individual uses two languages with equal facility. This may not be true of the language-cultural environment under consideration. Secondly, the present investigator questions whether previous research findings are due to bilingualism per se. Such findings are valuable but may well be regarded as products of the total environment in question.

The Problem

Purpose. The present investigation was concerned with the linguistic functioning of children of a Spanish and English language-cultural environment. The specific problem was to study the effect of this environment on linguistic functioning by comparing, in certain areas of language development, three groups of children who differed in certain identifiable aspects of language-cultural background but who were alike in nonlanguage intelligence, chronological age, grade, sex, and socioeconomic status. This was attempted by comparing three groups of children as follows: (1) Mexican-American children who had spoken both English and Spanish when they entered kindergarten; (2) Anglo-American children who had spoken only English when they entered kindergarten; and (3) Mexican-American children who had never spoken any language but English, but whose parents communicate in both English and Spanish.

Importance of the problem. Investigation of problems of language development perhaps needs no justification. The importance of language and communication

has been emphasized for a long time. As Bloch and Trager say:

> Every normal human being is a member of a social group, sometimes of more than one; and every human being depends in all his social activities, on the use of language. Without language, human society is unthinkable; language is the link between otherwise unconnected nervous systems, and thus the means by which a stimulus acting on one man may produce an effective response in another, or in all members of the group. (5)

Whorf (43) holds that cultural patterns are determined in part by native language characteristics. An earlier author, Boas (6), takes a different view. He states that culture shapes language, but that he has never found any evidence that culture is determined by language.

Evidence supporting either of these views appears to be far from conclusive. For present purposes, it is assumed that language and culture cannot be divorced. It is known that there are children of certain ethnic subcultures who learned two languages from infancy. The linguistic functioning of such children has been investigated. More research is needed because there are still unanswered questions. Findings of such research are important to educators in the Southwestern part of the United States who must deal with a large partially-acculturated Mexican population.

Terminology. For purposes of the present investigation, Mexican children who spoke both English and Spanish at the time they entered kindergarten are designated "English-Spanish" (E-S). Non-Mexican children, whose parents were born in the United States, and who have never spoken any language other than English are designated "Anglo-English" (A-E). Children whose parents or grandparents came from Mexico, and whose parents communicate in Spanish and English, but who themselves have never spoken any language but English, are designated "Mexican-English"(M-E). Symbols of the International Phonetic Alphabet are used to designate phonemes.

Background and Delimitation

Setting of the problem. The present study was conducted in three adjacent coastal communities in southern California. From the time of the ranches in the area which existed during Spanish and Mexican possession, there was little change until 1851 when a salt plant was established. The first subdivision seems to have occurred in 1887. The present communities are industrial rather than agricultural. Only about nine per cent of the enrollment in the three elementary school districts

is Mexican-American.

This Mexican-American population does not live in separate sections of the three communities. Typically, the Mexican-American family lives in a residential district which is shared by non-Mexicans of approximately the same socio-economic status.

Delimitation. A much larger Mexican population is found in many other communities of the Southwest. There, Mexican people are often housed relatively separately. They may have far less social contact with the non-Mexican population. Conclusions drawn from the present study may not apply to these people.

It should be noted also that this study did not investigate languages learned, per se, versus language development. It must be recognized that certain ethnic variables may inevitably be at work which also affect differences in linguistic functioning. If such differences are found to exist, when other known variables are controlled, such differences should be identified. That is the justification for the present study.

The Method

This was an ex post facto study. The variables were controlled statistically rather than experimentally. It was a comparative study of the language development of subjects from three populations, defined above under the classification Terminology. These were E-S children, A-E children, and M-E children. There were 30 subjects in each of the three groups. All were enrolled in grades seven and eight in three adjacent school districts in southern California. The three groups were matched for sex and grade. An effort was made to select subjects in such a way that there was no significant mean differences in chronological age, nonlanguage IQ, and socio-economic status rating.

The basic question of the study was whether there was a significant difference among the groups in certain areas of language development. Areas investigated were as follows:

1. Silent reading vocabulary
2. Silent reading comprehension
3. Total silent reading
4. Oral reading accuracy

5. Oral reading comprehension
6. Mechanics of English
7. Spelling
8. General language development
9. Consonant articulation
10. Inflection
11. Vowel production.

Vowel production included the location of the first two formants, duration, and fundamental frequency of ten vowels and two diphthongs.

Major Limitations

As was previously suggested, the subjects were from a relatively small area in southern California. The number of subjects was also limited to insure obtaining matched samples. These factors limit the value of the data, and conclusions must be drawn carefully.

A further limitation arose from the use of the California Test of Mental Maturity to determine the nonlanguage IQ's of the subjects. Since test results may be influenced by the language factor, another type of test might have been preferable but hardly feasible for the present study. Some justification from the CTMM as a measure of nonlanguage IQ for subjects of varying language background is found in the research of Kittell (17) cited and discussed in Chapter II.

It is doubtful whether an adequate control of intelligence is possible. It seems advisable, however, to attempt to control this variable by the best means possible, a nonlanguage test. In any case, it would provide information by which the subjects can be described.

Perhaps the most serious limitation lies in the difficulty of accounting for the socio-economic variable. A foreign population in a community may constitute a subculture. Class differences exist within the subculture. Yet the middle-class individual's parents' social contacts and relationships may be largely with other persons of varying classes. Thus it may be impossible to match children of different groups rigidly according to socio-economic status.

Finally, it should be remembered that the Spanish-speaking population in the

geographical area of the present study is relatively small. Language habits of the Spanish-speaking people may differ in a community where more of the inhabitants also speak Spanish. Generalizations may not apply to communities of larger Mexican populations.

Organization of the Remaining Chapters

Related literature, including previous research findings and conclusions, are reviewed in Chapter II. Included are the influence of language on intelligence test results, the influence of early use of two languages on language development characteristics of Spanish dialect speech, inflectional patterns of English, and sound spectographic studies.

The procedure followed and detailed data regarding subjects, in terms of the controlled variables, are presented in Chapter III. The statistical techniques are also given.

California Achievement Test results, as measures of silent reading, including both vocabulary and comprehension; mechanics of English, spelling, and general language development, are presented and analyzed in Chapter IV. Included also in this chapter are Gray Oral Reading Test results for both oral reading accuracy and oral reading comprehension. Wepman test results, the phonetic inventory county, and the ratings in regard to inflection are given and analyzed.

Sound spectographic data, as measures of vowel production, are given in Chapter V. These include the difference in cps between the second and first formants, vowel duration in ms, and the fundamental frequency in cps.

Summary, conclusions, and recommendations are presented in Chapter VI.

CHAPTER II

SURVEY OF RELATED LITERATURE

Literature dealing with this problem divides itself into five major categories. These are (1) language and intelligence tests, (2) bilingualism and language development, (3) characteristics of Mexican-American speech, (4) stress and inflection patterns of English speech, and (5) sound spectographic studies.

Language and Intelligence Tests

The present study dealt with language achievement rather than intelligence. Literature regarding the influence of language upon intelligence testing was deemed indirectly relevant, however. The present study compared children who had learned two languages from infancy with those who had learned only one. It was desirable to hold constant the nonlanguage intelligence variable. Thus, there was the problem of estimating the intelligence of both.

Language and verbal intelligence tests. It would seem obvious that reliable comparisons of intelligence of groups speaking different languages cannot be made by means of verbal tests. The bilingual person would be handicapped in his performance on such a test. Anastasi (2) states that the effect is likely to be most serious when the handicap is present to a mild degree. Lambert (18) has shown that the reaction time of bilinguals is faster when instructions are given in the language they know better. Johnson (15) found similar differences in the speed with which words are given by free association in the two languages. Altus (1) found bilinguals to have significantly lower verbal intelligence scores than monolinguals. Goodenough (13) found a high correlation between the mean IQ of children in immigrant groups and the proportion of parents who had adopted English as the language spoken at home.

Language and nonverbal intelligence. It appears that the influence of bilingualism on intelligence test scores diminishes when nonlanguage tests are employed. Arsenian (3) found no significant correlation between the extent of bilingualism and scores on the Pintner Non-Language Test. Similar results were obtained by Darcy (9) in his study of nursery school children. He found significant differences in favor of monolinguals on the Stanford-Binet, and significant differences in favor of bilinguals on the Atkins

Object-Fitting Test.

Lewis (19) found nonverbal intelligence of Welsh school children to be influenced by the language spoken in the home. His subjects were tested on the Jenkins Non-Verbal Scale of Mental Ability. Jones (16) questioned the language questionnaire used by which Lewis obtained his language background data. He also stated that the Bangor survey of 1951 had suggested a significant difference between bilingual and monolingual children in nonverbal IQ. Yet, he said, when the Bangor results were reanalyzed, taking socio-economic status into account, no significant difference was found.

Kittell (17) administered the California Test of Mental Maturity to a sample of bilingual third-grade children and one of monolingual third-grade children. Socio-economic class differences were in favor of the monolingual group. Higher scores were obtained on the language section for the monolingual group. The monolingual children achieved higher scores on the language section than on the nonlanguage section. On total mental age there was no significant difference between the two groups.

Brown (7:314) concluded that the use of nonlanguage mental age scores does not remove the ethnic differences in measured intelligence although it tends to diminish them slightly.

The foregoing suggest that there are definite limitations upon the reliability of matching children of different language backgrounds and ethnic groups in intelligence. Even so, it appears that the influence of bilingualism and ethnic factors diminish when nonlanguage tests are used.

Bilingualism and Language Development

In this section, earlier and more recent studies of bilingualism and language development are discussed separately. It appears that the earlier studies have in common certain limitations in terms of extraneous relevant variables than do the later reported investigations.

Earlier studies. Smith (31) studied a family of eight children who made frequent moves between China and American and who were exposed to two languages for varying periods and from different sources. She concluded that a bilingual environment is not likely to delay the first use of words. The handicap, she said, if it occurs, is likely to appear later.

Later, Smith (32) investigated 1000 children of varying racial backgrounds

and degrees of bilingualism in Hawaii. She estimated from her observations which groups heard more English and which heard least English. Her findings were that the Japanese, who heard the least English, used 50 per cent English words. The total group used about 88 per cent English words. Smith concluded that bilingual environment causes serious language retardation which cannot be compensated for by having a second language.

In the two foregoing studies, questions might be raised in regard to procedure and treatment of data. Also, no attempt was made to account for intelligence or socio-economic status. Other relevant factors may also have been ignored. It may have been that certain of those subjects were children of missionaries or professional people. Heredity factors or child-rearing practices may have influenced development quite as much as the language which the child heard. Studies by Fritz and Rankin (12) and Manuel (22) indicate that bilingualism affects language development adversely. In these studies, neither intelligence nor socio-economic status was accounted for.

More recent studies. Lewis (20), in a study of 375 ten-year old Welsh school children, found English attainment influenced adversely by Welsh language background. Lewis controlled nonverbal intelligence in this study.

Perhaps one of the most significant contributions to the literature related to the present problem is supplied by Carrow's study (8). A major difference between it and the present investigation is that Carrow's subjects were third-grade children. Carrow raised the question as to whether certain results might not have been different had the subjects been of a higher-grade level. She compared 50 Spanish-speaking bilinguals with 50 monolingual English-speaking children. Subjects were matched on the basis of age, socio-economic status, and intelligence (as measured by the Otis Quick-Scoring Mental Ability Test, Alpha, Non-Verbal, Form A). She found significant differences between the groups in favor of the monolinguals in oral reading accuracy, oral reading comprehension, hearing vocabulary, arithmetic reasoning, and speaking vocabulary. No significant differences were found in silent reading comprehension, silent reading vocabulary, oral reading rate, spelling, verbal output, length of clause, and degree of subordination. The bilingual group made more articulatory and grammatical errors. Articulatory errors of the bilinguals consisted mostly of substitutions. Articulatory errors of the monolinguals consisted mostly of distortions.

Bilinguals at all levels of intelligence scored lower in total language achievement test scores than monolinguals at corresponding levels, except for those of 121

IQ and over. This group either attained or surpassed the achievement of monolinguals in the same category on all language achievement tests except hearing vocabulary. Because of the small number of subjects in each category, statistical analyses were not made to compare the groups at different intelligence levels.

As to why there should be no significant difference between the groups in silent reading vocabulary, Carrow suggested that it is so because at the third-grade level, performance in reading depends largely on recognition of words previously learned in reading class. She cited Russell (30) who said that in general a small speaking and understanding vocabulary will not begin to affect reading success of children until some time in the third grade.

Black and Grinder (4) administered Forms A and B of the Full-Range Picture Vocabulary Test (FRPV) and the Vocabulary, Effectiveness of Expression, and Total English subtests of the Cooperative English Tests to 40 bilingual and 37 monolingual freshmen college students who were third generation Japanese. They found the two forms of the FRPV, which are relatively independent of ability to express oneself in language, to correlate .81. Correlations among the English subtests ranged from .56 to .78, indicating that the two tests give comparable measures of verbal comprehension for this sample. While other research suggests that bilingualism may affect language development during childhood, Black and Grinder said that the "present data suggest such influence may have little effect by late adolescence."

While the interpretation of their data by Black and Grinder is open to question, other research also seems to support this conclusion. Spoerl (33) found bilingual freshmen to excel monolingual freshmen in college achievement. Subjects were matched according to sex, age, intelligence, and socio-economic status. All were of 121 IQ or above.

Brown (7:308) found a significant relationship between achievement and language spoken in the home for Mexican-American fourth-grade children, but not sixth and eighth-grade children.

Summary of section on language achievement. Early studies, which did not control intelligence and socio-economic status, suggest that bilinguals are retarded in certain areas of language achievement. In some later studies, efforts

were made to control such variables as intelligence and socio-economic status. Results were found in favor of monolinguals in certain areas of language development. It was theorized that among older children, such retardation might be greater. Differences in favor of monolinguals were not found to exist among children of 121 IQ and over. Certain studies among college freshmen revealed no superiority of monolinguals in language achievement.

Characteristics of Mexican-American Speech

Lynn (21), in her investigation of the speech of Mexican-American children, found the following English phonemes to have one or more substitutions of Spanish sounds which have organic relationships to the English:

ʃ, ʧ, ʒ, ʤ, θ, ð, ɫ, ʌ, ɹ, AND ɜ˞.

She also found a difference in the way sounds similar in both languages are produced. The plosives p, b, t, d, k, and g afford the best examples of this type of change. Differences, she stated, are not only in voicing and voicelessness, but also in aspiration and tension. The Mexican child uses the less fortis unaspirated p.

Further results of Lynn's study showed confusion of the use of sounds with orthographic spelling. An example is the voiced and voiceless th sounds: and . There was found too to be insufficient transition sounds (organic glide) between sounds of connected speech. All vowels of Mexican-English were found to be shorter than the corresponding General American vowels. Finally, there was found to be a difference in sound and sense stress which leads to unnatural stressing of the unstressed sounds and sound combinations.

The incidence of these variants described by Lynn, she found, does not decrease noticeably with increased age and skill of the speaker.

Lynn concluded that reasons for these characteristics of Mexican-American speech are that the Mexican child uses the native language from babyhood and then begins trying to learn English habits before the old habits are well established.

Perhaps one of the most noticeable characteristics of foreign-dialect speech is the deviation from the inflectional pattern of English. Van Riper says:

> Probably the most difficult of all characteristics of foreign speech to eradicate is the old melody pattern of the sentence. Each language has its own system of inflection patterns, and, since they are not recorded by symbols,

they are relatively unconscious and hence difficult to eliminate. (40:487)

The unnatural stressing of unstressed English sounds, observed by Lynn (21) would account for a noticeable difference in the inflection of the Spanish dialect speaker's English speech. This is apparent when one examines the stressing and unstressing of standard English speech.

Stress and Inflection Patterns of English Speech

Van Riper says:

1. In English, we tend to alternate stressed and unstressed syllables.
2. Words of three or more syllables are accented on the first syllable except when it is a prefix.
3. Compound words are accented on the first syllable. (40:487)

It appears that variations in pitch account primarily for inflection. There is, of course, the basic pitch level of a speaker's voice, as Fries (11:20-21) points out. For children and women, this level will be higher than for mature men. In general, however, as Fries says, this difference in basic pitch is not significant linguistically. It is the patterns or contours of pitch changes which constitute a linguistic problem. Fries cites the following example:

> . . . if we pronounce, in a relaxed normal American English way, the sentence "He went to the office" we may observe three important matters of pitch.
>
> 1. The first four words seem to be practically on a level--the normal pitch level of the voice of the speaker.
> 2. The first syllable of the word "office" is distinctly higher than this normal pitch level of the speaking voice.
> 3. The last syllable of the word "office" is distinctly higher than the normal pitch of the speaking voice. (11:20-21)

How then are pitch changes, or inflection to be precisely and reliably measured? The term "pitch" is often used interchangeably with the term "frequency." The former denotes a psychological phenomenon. The latter refers to a physical phenomenon.

The findings of Stevens, Volkmann, and Newman (36) suggest that pitch is indeed primarily a function of frequency. However, as Stevens and Davis (35:70-75) point out, many investigators, during the last hundred years, have noted an apparent change

in the pitch of a tone with a change in intensity. This was shown by Zurmuhl (44). The research of Miles (23) and Stevens (34) has shown that a change in intensity results in a change in pitch. Finally, as Ekdahl and Boring (10) have shown, the pitch of a complex sound depends upon the frequency of its dominant components. Thus it is concluded that pitch is chiefly a function of frequency but is also dependent upon the intensity and composition (10:454).

It would seem that measurements or comparisons of pitch (a psychological phenomenon) would perhaps have to be made by the qualitative judgments of listeners. The physical variables which account for pitch changes may perhaps be made by more reliable methods.

Sound Spectographic Studies

There appear to have been no previous studies of language development based on acoustical measurements of speech sounds. The description of the sound spectograph by Potter et al. (28) suggests that such analyses are possible. Peterson and Barney (27) concluded from their data that both the production and identification of vowel sounds by an individual depend on his previous language experience. These investigators were primarily concerned with dialect influences. From the data of Potter and Steinberg (29), it is shown that, although formant* ratios remain fairly stable, the formant positions vary systematically with age and sex.

Tiffany (39) in his investigation of sources of variation of vowel quality, demonstrated a technique for measuring and comparing the fundamental frequency of a vowel as spoken by different subjects. He made this type of comparison in addition to comparisons of duration and formant position. He found some evidence that, in general, the differences among the several vowel resonances tended to be greater for the stressed than for unstressed vowels, and greater for the trained than for the untrained speakers. Also, results of this study included a significant difference in frequency and duration between stressed and unstressed vowels.

Peterson (26), in investigating parameters of vowel quality, concluded that formant amplitudes, fundamental voice frequency, and phonetic environment, in addition to formant frequencies, all appear to have an influence upon the perception of vowel qualities.

*The formant designates the resonance region.

Sound spectographic studies suggest a means of comparing the speech sounds of different subjects which may be more reliable than the traditional qualitative methods.

Evaluation of Previous Research

It seems probable that certain extraneous relevant variables were not controlled in a great deal of the research regarding language development of bilinguals. Results of certain studies suggest that the monolinguals excel the bilinguals in certain areas of language development. It is not indicated that these studies take into account the language of the parents or the limitations of the English language as spoken in the home. It seems probable that the parents who taught their children two languages simultaneously may have spoken English with a foreign dialect and with a limited vocabulary. Had these same parents insisted that their children speak only English, the children would have been what various investigators called "monolingual." Yet, would there have been any acceleration in their language development? Certain of these studies would have been more valuable had comparisons been made with monolingual children of foreign-language-speaking parents.

There is also the probability of other unknown ethnic factors that may account for a bilingual child's language development or lack of it.

Difference in articulation, as judged by sophisticated English-speaking listeners, were revealed by the foregoing research. The reporting of such findings is certainly justified. However, it might well be pointed out that actual acoustical differences between the speech of monolinguals and bilinguals are not included. The judging of speech differences by even the best-trained listeners is subject to a degree of subjectivity.

Possibly differences in the ability to discriminate American-English phonemes may account for certain of the previous findings and conclusions. These have not been reported. It appears that two sounds may be phonemically different to one who speaks a given language; yet, such a difference may be undetected when heard in context by one who speaks a different language. One may become aware of this when he attempts to imitate a sound of a foreign language phoneme which is absent from his native language. Studies of the ability of bilingual children to distinguish English phonemes appear to be absent from existing research literature.

Summary of the Chapter

It appears from previous research that in certain areas of language development, monolingual children excel bilingual children at the third-grade level. Some evidence suggests that at the college level, bilinguals equal or excel monolinguals. This may be so because the differences between bilinguals and monolinguals diminish as the children mature and advance in school. It may be that such differences do not exist among children of higher IQ and/or higher socio-economic status. Which of these possibilities is more likely remains to be determined. Previous research seems to have not taken into account certain possible extraneous variables. Among these are the number of languages spoken by the parents and the dialect spoken by the parents. The influence of these variables bears further investigation. Finally, differences in inflection, a noticeable characteristic of foreign-dialect speech, seems to have been ignored in much previous research.

CHAPTER III

SOURCES OF DATA, PROCEDURE, AND HYPOTHESES

The problem to be investigated and a review of selected previous research have been presented in the first two chapters. The present chapter is devoted to sources of data, including detailed information regarding the subjects, and a statement of the procedure.

Independent Variable Data

Selection of subjects. In order to obtain subjects for the present study, seventh and eighth grade class lists were obtained from the three school districts in which the study was conducted. These were scrutinized and all Spanish surnames were copied. The cumulative records of children bearing these names were examined. If the cumulative record revealed that a child was not of Mexican parentage or grandparentage, or that neither he nor his parents had ever spoken Spanish, his name was eliminated.

Dropped also from the list was any child who had a record of a hearing loss, an organic speech defect, an IQ of below 75 (total or nonlanguage), or who had been referred to a school guidance department as a behavior problem, or as potentially "neurologically injured" or "emotionally disturbed."

Each child remaining on the list was interviewed and questioned as to whether he had ever spoken Spanish. The schools in which these children were enrolled had recently embarked upon a program of Spanish instruction. Each child's teacher and Spanish teacher was interviewed as to whether it appeared the child had previously spoken Spanish. In any case in which it appeared doubtful as to whether he enrolled in kindergarten, his name was eliminated from the list.

If it was ascertained that the child had spoken both Spanish and English at the time he entered kindergarten, he was classified as English-Spanish (E-S), as defined in Chapter I. If it appeared certain that he had not spoken any language other than English, but that his parents could and did communicate in both Spanish and English, he was classified as Mexican-English (M-E), as defined in Chapter I.

Each subject was classified as to socio-economic status according to the

scale developed by Warner et al. Details of this scale and its application are given in the next section.

An effort was made to match subject for subject a pair of children of each classification according to grade, sex, and (as nearly as possible) chronological age, non-language IQ, and socio-economic status.

After 30 pairs had been thus selected, subjects bearing what appeared to be Anglo-American names were selected and matched with the E-S and M-E subjects on the basis of grade, sex, and (as nearly as possible) chronological age, nonlanguage IQ, and socio-economic status. These children were placed tentatively in the A-E group. Each potential A-E subject was interviewed and his cumulative record was examined to ascertain that he was of Anglo-American parentage and that he spoke no language other than English. If a student did not meet these criteria, he was disqualified as a subject, and another was selected. No member of any ethnic minority was selected for the A-E group.

During the process of selecting subjects when two children seemed to satisfy the criteria equally well, the selection was made by flipping a coin.

In the manner described in the foregoing, three groups of 30 subjects each were selected. Independent variable data for each subject are shown in Table 1, 2, and 3. It will be noted that there is no mean difference in nonlanguage IQ between any two groups which is not less than four points. Also, the greatest difference between groups in chronological age is less than one month, and the greatest mean difference in socio-economic status rating is less than one point.

Instruments for selection. The remainder of the present section is devoted to the measurement of nonlanguage IQ and the estimate of socio-economic status of the subjects.

Nonlanguage intelligence was assessed by means of the California Test of Mental Maturity. Limitations arising out of the use of this test are acknowledged in Chapter I. According to the description of the test published by the California Test Bureau, coefficients of reliability were computed by the split-halves method and corrected by the Spearman-Brown formula. Data were obtained from testing 200 subjects in grade eight. The reliability coefficient of the nonlanguage scores was .72. The standard error of measurement of the nonlanguage scores was 8.5. In an effort to

TABLE 1

Subjects: English-Spanish Group

Identifying Number	Non-language IQ	CA	SES	Parental Occupation	Sex	Grade	School
181	120	157	4	Carpenter	M	8	1
182	86	161	5	Gardener	F	8	1
183	121	156	7	Janitor	M	8	1
184	102	159	3	Service-station owner	F	8	1
175	110	146	5	Gardener	M	7	1
177	80	164	7	Common laborer	M	7	1
176	109	143	4	Parking meter repairman	F	7	1
178	94	162	4	Foreman	F	7	1
1710	103	152	3	Laboratory technician	F	7	1
1720	99	152	7	Common laborer	F	7	1
2814	97	157	3	Small business proprietor	F	8	2
2816	95	151	6	Electrician's helper	F	8	2
289	98	164	4	Machinist	M	8	2
2818	118	156	4	Machinist	F	8	2
2820	107	159	5	Clerk	F	8	2
2812	97	157	3	Planner--aviation company	F	8	2
2824	85	159	4	Nursery business owner	F	8	2
2826	102	160	4	Machinist	F	8	2
2811	79	166	5	Time-keeper	M	8	2
3813	92	162	4	Electrician	M	8	3
3715	81	146	4	Machinist	M	7	3
4728	108	141	2	Real estate salesman	F	7	4
4817	104	156	3	Backing company salesman	M	8	4
3819	118	158	3	Maintenance supv., airport	M	8	3
5821	106	157	4	Mechanic	M	8	5
5830	101	162	5	Plumber's apprentice	F	8	5
5723	96	144	5	Tinner's apprentice	M	7	5
5725	83	164	5	Hardware salesman	M	7	5
5832	121	161	2	Asst. manager, manufg.	F	8	5
5827	95	164	3	Automobile salesman	M	8	5
Means:	100.27	156.54	4.23				

Total male: 14
Total female: 16

Total grade eight: 20
Total grade seven: 10

TABLE 2

Subjects: Anglo-English Group

Identifying Number	Non-language IQ	CA	SES	Parental Occupation	Sex	Grade	School
1833	95	168	2	Aeronautical engineer	M	8	1
1835	118	160	3	Planner, aviation company	M	8	1
1836	113	156	2	Registered nurse	F	8	1
1837	114	166	4	Carpenter	M	8	1
1838	107	155	4	Carpenter	F	8	1
1840	95	160	2	Real estate salesman	F	8	1
1739	110	142	4	Bookkeeper	M	7	1
1742	109	148	7	Common laborer	F	7	1
1741	113	144	4	Plumber	M	7	1
1743	84	161	7	Common laborer	M	7	1
2845	87	164	4	Painter	M	8	2
2847	95	174	4	Plasterer	M	7	2
2844	112	158	4	Small grocery owner	F	8	2
2846	109	158	3	Service station owner	F	8	2
2849	114	155	3	Retail salesman	M	8	2
2848	116	158	3	Service Station owner	F	8	2
3850	92	163	3	Automobile salesman	F	8	3
2752	106	144	3	Bank clerk	F	8	2
3851	86	159	6	Carpenter's helper	M	8	3
3854	116	156	3	Retail salesman	F	8	3
3853	89	163	5	Lineman	M	8	3
3856	113	156	5	Dime store clerk	F	8	3
5855	107	164	4	Plumber	M	8	5
5758	86	149	5	Service station attendant	F	7	5
5760	119	146	5	Plumber's helper	F	7	5
5757	98	149	3	Automobile salesman	M	7	5
4859	98	164	4	Bookkeeper	M	8	4
5862	84	164	6	Service station attendant	F	8	5
5764	113	147	3	Automobile salesman	F	7	5
5766	105	150	3	Bank clerk	F	7	5
Means:	103.43	155.7	3.97				

Total male:	14
Total female:	16
Total grade eight:	20
Total grade seven:	10

TABLE 3

Subjects: Mexican-English Group

Identifying Number	Non-language IQ	CA	SES	Parental Occupation	Sex	Grade	School
1867	119	158	4	Foreman	M	8	1
1868	95	169	4	Carpenter	F	8	1
1870	88	162	4	Electrician	F	8	1
1772	104	146	4	Plumber	F	7	1
1774	84	146	4	Carpenter	F	7	1
2769	103	147	2	Insurance Salesman	M	7	2
2876	87	165	5	Cook	F	8	2
2878	113	166	4	Foreman	F	8	2
2880	109	158	4	Bookkeeper	F	8	2
2871	114	166	3	Automobile salesman	M	8	2
2882	115	151	3	Bank Clerk	F	8	2
2873	114	158	4	Plumber	M	8	2
2884	110	160	4	Retail salesman	F	8	2
2875	110	164	4	Carpenter	M	8	2
2886	108	159	3	Secretary	F	8	2
2777	102	140	4	Foreman	M	7	2
2888	81	156	4	Machinist	F	8	3
3790	88	136	4	Carpenter	F	7	3
3879	131	157	4	Machinist	M	8	3
3792	129	143	3	Salesman	F	7	3
3894	114	163	3	Laboratory technician	F	8	3
5881	86	161	4	Carpenter	M	8	5
5883	107	166	4	Plumber	M	8	5
5896	86	166	3	Refrigeration engineer	F	8	5
5785	87	144	4	Machinist	M	7	5
5887	129	156	4	Bookkeeper	M	8	5
5789	97	153	4	Retail salesman	M	7	5
5791	108	154	4	Stenographer	M	7	5
5798	112	146	3	Copy writer	F	7	5
5893	91	163	4	Electrician	M	8	5
Means:	104.03	155.97	3.73				

Total male: 14
Total female: 16

Total grade eight: 20
Total grade seven: 10

assess the validity of the test, Altus (37:6) correlated results from the California Test of Mental Maturity with those from the Wechsler Intelligence Scale for Children. He found CTMM (Short-form) nonlanguage scores to correlate .67 with WISC performance scores.

It appears that the reliability of this test is lower than should be desired for a study of this kind. Also, if the WISC Test is accepted as a reliable and valid test of nonverbal intelligence, the validity of the CTMM is quite low. For this study, a more valid measure of intelligence was desired but not feasible. It was deemed preferable to utilize available CTMM data as one basis for selecting the subjects for each group rather than make no effort to control the nonlanguage IQ factor.

The investigator obtained the CTMM nonlanguage scores from guidance department records in the three school districts. Testing in each school had been done by the principal or by a team of selected teachers. In all cases, the examiners had been carefully briefed by personnel in the guidance departments and had been familiarized with the tests. The tests were then machine scored.

Limitations in regard to estimating the socio-economic status of each subject were also discussed in Chapter I. Here again, it was believed preferable to use an available, feasible method, despite its limitations, than to make no effort to control socio-economic status. Previous research, cited in Chapter II, suggests that results are different when such methods are used from those of research in which no consideration is given to socio-economic status.

Parental occupation was obtained from each subject's cumulative record. This was checked by an interview with the subject and with his teacher. Each subject was then classified according to a scale developed by Warner et al. (Appendix, Table 20).

Dependent Variable Data and Procedure

This section describes the instruments for obtaining data on the dependent variables measured and the procedure followed.

California Achievement Test. CAT scores were obtained from the records in the guidance department in each school district. This test, like the CTMM, had been administered by the principal or a team of teachers, carefully briefed by personnel in the guidance department. The test was machine scored.

Scores on this test were used as measures of silent reading vocabulary, silent reading comprehension, mechanics of English, spelling, and general language development. Justification of this test is its acceptability by the school districts in which the study was conducted. Whether or not there are more reliable and valid tests of achievement, since the test is accepted by the school systems concerned, it would behoove one investigating the language development of certain of the enrollees to consider results from this test. Also, the investigator considered it desirable to compare findings regarding the silent reading ability of children in grades seven and eight with those of the Carrow study (10), subjects of which were third grade children. There was an advantage in using the CAT as did Carrow.

The junior high level California Achievement Test, according to information released by the publisher (38:8), was standardized on the basis of results obtained from testing a sample of eighth grade students. Reliability coefficients were obtained, using the Kuder Richardson formula. These reliability coefficients (Appendix, Table 21), ranged from .83 to .95.

The publishers present (38:9-11) a defense of the content validity of the test on the basis of ratings of each test item made by curriculum experts, research specialists, college professors, teachers, and state department of education personnel. Results from ratings on a four point scale are presented to show that none of the raters considered any section of the test inconsequential or comparatively unimportant. Virtually all rated the various parts of the test as at least fairly significant, or major importance, or as presenting essential concepts or information. All parts of the tests were analyzed in this manner except the section on spelling.

Gray Oral Reading Test. Oral reading accuracy and comprehension were measured by means of the Gray Oral Reading Test (14). According to the publishers (14:24-29), this test was standardized on the basis of scores of 502 representative subjects in grades one through twelve. Mean chronological age and IQ, with standard deviations, were computed for boys and girls separately for each of the 12 grades. Variance of total scores was evaluated in a three-way analysis of variance with sex, age, and the four forms of the test. The resulting F ratio due to grade level was the most significant. The ratio due to sex was also significant beyond the .01 per cent level. Forms B and D were found to be similar. Form A was found to be easier and Form D more difficult.

The standard error of measurement of Form A was found to be 3.81 for the boys and 1.98 for the girls.

Coefficients of intercorrelation coefficients of equivalence) among grade-scores on each of the four forms was .973 to .982 for all subjects; .977 to .981 for girls; and .969 to .983 for boys.

Concerning the validity, the publishers say:

> These tests are valid primarily because of the procedures . . . used in constructing them.
>
> The fact that pupils randomly selected from "representative groups" as judged by the cooperating schools obtained scores that distinguish one grade from another indicates concurrent validity. (14)

The test was administered to the subjects by the investigator, after briefing by and practice under the direction of a reading consultant in the curriculum department of one of the participating school districts. Directions in the Manual of Directions for Administering, Scoring, and Interpretation (14) were followed. Each subject was directed to begin reading aloud the passage which was two below the average level for his age. If he made an error, he next tried the preceding passage. This practice was continued until he read one without errors. After the subject had read a passage without errors, he read the next succeeding passage until he had made seven or more errors on each of the two succeeding passages. The number of seconds it took the subject to read the passage and errors were recorded in the Examiner's Record Booklet, in accordance with official directions. The comprehension questions were asked and the answers recorded.

When a subject had completed the test, the scoring was done immediately before another subject was tested. The results were recorded in the Examiner's Record Booklet.

Wepman Auditory Discrimination Test. Phonemic discrimination was measured by the Auditory Discrimination Test, Form I, by Wepman (42). The test consists of 40 pairs of words. Each pair is presented audibly to the subject, and he is directed to indicate whether the two words are the same or different.

According to the published description of the test (42), the word-pairs selected were matched for familiarity by selecting words as closely together as possible from the Lorge-Thorndike Teacher's Word Book of 30,000 Words (1944). It is stated that

every possible match of phonemes used in English was made within phonetic categories. Thus phonemes within the articulatory category of simple stops (p, t, k) were matched only with other phonemes within that category. No cross phonetic category matching was done. Vowel comparisons were made in terms of three criteria: (1) the part of the tongue raised, (2) the position of the lips, and (3) the height of the tongue.

The test was standardized with 533 unselected first, second, and third grade children in both urban and nonurban communities. Cut-off points were determined for children at ages of five through eight.

A test-retest administration to 109 children showed a reliability of .91. The difficulty of each phoneme on the two forms of the test showed a Pearson rank order correlation of .67. Number of subjects was 214.

From statements offered by the publishers to establish the validity of the test, the following are given:

2. Of twenty-four children examined for articulatory disorders in a three-month period at the University of Chicago Speech clinic, twenty-two showed inadequate auditory discrimination.

3. Of one hundred thirteen children ranging in age from seven through fifteen years referred to an urban remedial reading clinic (Joliet, Illinois), twenty-three showed inadequate discrimination, eighty-six showed adequate discrimination, and four showed invalid tests.

4. Of two hundred thirteen children referred to an urban remedial reading program for study (Clearwater, Florida) from the fourth grade only, ninety-four showed inadequate auditory discrimination; one hundred fourteen showed adequate auditory discrimination, and five showed invalid tests.

5. Of eighty children in the first grade of a non-urban consolidated school (Elmhurst, Illinois), fifty-eight showed adequate auditory discrimination; reading mean scores were 2.2, the I.Q. mean was 111. Twenty-two showed inadequate auditory discrimination for their age; reading mean scores were 1.9, the I.Q. mean was 106.5.

The differences in auditory discrimination and in reading were significant (1% level), while the difference in I.Q. was not significant.

6. Of seventy-six children in the second grade of the same non-urban consolidated school (Elmhurst, Illinois) sixty-two showed adequate discrimination scores; reading mean scores were 3.5, the I.Q. mean was 115. Fourteen showed inadequate auditory discrimination scores; reading mean scores were 2.8, the I.Q. mean was 108.

The differences in auditory discrimination and in reading were significant (1% level); the difference in I.Q. was also significant, but at the 5% level. (42)

The investigator administered the test to each subject, according to official directions, in the following manner. While the subject faced the examiner, these instructions were repeated: "I am going to read some words to you--two words at a time. I want you to tell me whether I read the same word twice or two different words. Remember, if the two words are exactly the same, say 'yes'; if they are not exactly the same, say 'no.'" From three to six pairs were tried for practice, until the subject indicated that he understood what he was expected to do. While the pairs were read, the subject sat 15 feet from the examiner, with his back turned to the examiner. After the practice pairs were read, the 40 word-pairs were read. No word-pairs were repeated. On the test sheet, a plus was recorded after each pair to which the subject responded correctly. A minus was marked for each error.

In scoring the test, as according to directions, the number of errors in which the subject answered "yes" and when he answered "no" were totaled. These were called the x score. The number of errors in which the subject answered "no" to word-pairs which were the same were totaled and called the y score. According to directions, a test having an x score more than 15 or a y score more than three should be rejected as invalid. Only x scores were used in determining the level of each subject's discrimination.

The phonetic inventory. Articulatory errors were estimated by having each subject identify the pictures on the 16 Test Cards, Set A, published by Scott, Foresman and Company. Words used to identify the pictures contain sounds of the basic English phonemes. Each occurs in the initial, medial, and final position.

It is the opinion of the present investigator that a case has hardly been made in favor of the reliability or validity of scores on articulation tests. However, it seems that it was desirable to make an effort to assess articulation in an investigation of language development. The present method was utilized as one which appears to be the most feasible.

Each subject was simply asked to identify each picture. Consonant substitutions, distortions, additions, and omissions were noted in phonetic transcription. Vowels were not included.

Each error was classified as to whether it was a substitution or another kind of error (distortion, omission, or addition). The error was transcribed, as was the correct sound, and errors of different classes were counted.

Inflection. In Chapter II it was suggested that perhaps one of the greatest distinguishing characteristics of foreign-dialect speech is inflection. Problems of measurement were also mentioned. Despite the subjectivity of judgments of differences in inflection, its significance is great enough that it cannot be ignored in the present study.

Each subject was shown a picture. The investigator then told the subject to look at it for a moment. Then he said: "When I turn on the tape recorder, I want you to tell what you think is happening in the picture. What kind of people do you see? Where are they from and where are they going? What are they doing and how are they dressed? What does the old fellow behind the desk think about the situation?"

A three-minute speech sample was thus recorded for each subject.

The samples were all re-recorded in random order (using a table of random numbers). No name was attached to any sample. Samples were numbered for purposes of identification.

Three credentialed public school speech correctionists, after instructions and a suitable practice period, listened to the samples and rated them on a five-point scale, with one being the highest rating. Instructions, presented orally and in writing, were as follows:

"All the speakers are seventh and eighth grade students. Listen to each sample. Rate it as to quality of inflection as typifies good general American English speech. If a sample is only average, rate it 3. If it is above average, rate it 2. If it is below average, rate it 4. If it is extremely good or outstanding, rate it 1. If it is very poor, rate it 5."

The ratings of each judge were recorded, as were each subject's total ratings by all three judges (total scores).

Sound spectographic data. A description of the sound spectograph, as presented by Potter et al. (28:11-12), is summarized briefly as follows. A brief sample of speech is spoken or played into a microphone. This sample is recorded on a loop of magnetic tape. Then the magnetic tape record is reproduced over and over again.

The repeated speech sample goes to the input of a variable filter. First, it is adjusted to some starting frequency (perhaps 50 cycles per second). Its tuning is then shifted at approximately 15 cycles at a time for each repetition of the words. The filter output is connected to a stylus resting upon electrically sensitive paper wrapped around a drum. The simple oscillations separated out from the complex wave are recorded side by side as both the filter tuning and stylus position shift together over the frequency range. This causes there to appear on the paper a picture of the intensity-frequency-time distribution, where frequency and time are shown by the shade of darkness.

It would seem that measurements made by means of the sound spectograph would be much more precise and objective than qualitative judgments regarding speech sounds. At present, its use is restricted largely to measurements of vowels. Technical problems make it difficult to secure data from a large number of subjects. Without a soundproof room in which to record samples, there is the problem of ambient noise which may distort and invalidate the spectogram.

Spectographic data were obtained for the present investigation by the following procedure. Each subject was asked to repeat the sentence: "Joe took father's shoe bench out and laid it on the lawn." This sample was selected because of the large number of phonemes represented in a single sentence. The subject practiced repeating the sentence several times. Then the sample was tape-recorded. The taped samples were sent to the speech laboratory in the Department of English at the University of California at Los Angeles and two broad-band spectograms were made for each subject.

Measurements were made in cps* of the first and second formants** of each of the vowels o , ʊ , ɑ , ɔ , u , ɛ , ɪ , ɪ , ɔ , and the results were recorded. These measurements were made at a point one-fourth the duration of the whole vowel. Measurements were also made of the first two formants of the diphthongs and . Here measurements were made at the beginning and at the end of the diphthong.

Duration in ms*** was measured for each vowel and diphthong.

Fundamental frequency in cps was determined by averaging the number of vertical striations of the spectogram over a .05-second interval in the mid-portion of

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* cycles per second
** designates resonance regions
*** milliseconds

the vowel.

Statistical Treatment

As was stated in Chapter I, the purpose of the present investigation was to study the linguistic functioning of children of a certain language-cultural environment. Specifically, the study was designed to compare, in certain areas of language development, three groups of children as follows: (1) Mexican-American children who had spoken both English and Spanish when they entered kindergarten (E-S), (2) Anglo-American children who had spoken only English when they entered kindergarten (A-E), and (3) Mexican-American children who had never spoken any language but English, but whose parents communicate in both English and Spanish (M-E). The three groups were alike according to chronological age, grade, sex, nonlanguage intelligence, and socio-economic status.

Except for consonant articulation, a three-way analysis of covariance was made, with nonlanguage IQ as the covariate. Inasmuch as the number of articulatory errors for each group did not approximate a normal curve, chi-square was used to test the significance of the difference among groups for that set of results.

In computing the chi-square, the number of obtained scores in two of the cells was less than five. This raised a question as to the validity of the chi-square. For this reason, Wilcoxon Matched Pairs Signed Ranks Tests were also computed to analyze the consonant articulation results.

The null hypothesis was accepted as tenable in each case in which the difference among groups was not significant at .05. In cases in which the difference among groups was significant at .05 and the null hypothesis was rejected, a Duncan test was used to determine which specific groups differed significantly from each other. Following are statements of the null hypotheses.

Hypotheses regarding achievement in reading, mechanics of English, and spelling.

1. There are no mean differences among the E-S, A-E, and M-E groups in silent reading vocabulary for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

2. There are no mean differences among the E-S, A-E, and M-E groups in silent reading comprehension for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

3. There are no mean differences among the E-S, A-E, and M-E groups in total silent reading for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

4. There are no mean differences among the E-S, A-E, and M-E groups in mechanics of English for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

5. There are no mean differences among the E-S, A-E, and M-E groups in spelling for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

6. There are no mean differences among the E-S, A-E, and M-E groups in general language achievement (total silent reading plus mechanics of English plus spelling) for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

7. There are no mean differences among the E-S, A-E and M-E groups in oral reading accuracy for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

8. There are no mean differences among the E-S, A-E, and M-E groups in oral reading comprehension for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

Hypotheses regarding achievement in phonemic discrimination, consonant articulation, and inflection.

9. There are no mean differences among the E-S, A-E, and M-E groups in the discrimination of English phonemes for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

10. There are no mean differences among the E-S, A-E, and M-E groups in the number of errors in English consonant articulation for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

11. There are no mean differences among the E-S, A-E, and M-E groups in inflection for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

Hypotheses regarding vowel production.

12. There are no mean differences among the E-S, A-E, and M-E groups

in the remainder, in cps, of the second formant minus the first formant, in the production of O , in the word "Joe," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

13. There are no mean differences among the E-S, A-E and M-E groups in the duration of the vowel O , in the word "Joe," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

14. There are no mean differences among the E-S, A-E and M-E groups in the fundamental frequency of the vowel O , in the word "Joe," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

15. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the first formant minus the second formant, in the production of U , in the word "took," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

16. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel U , in the word "took," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

17. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel U , in the word "took," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

18. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, in the production of ɑ , in the word "father's," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

19. There are no mean differences among the E-S, A-E and M-E groups in the duration of the vowel ɑ , in the word "father's," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

20. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ɑ , in the word "father's," for seventh

and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

21. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps of the second formant minus the first formant, in the production of ɑ , in the word "father's," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

22. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel ɑ , in the word "father's," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

23. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ɑ , in the word "father's," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

24. There are no mean differences among the E-S, A-E and M-E groups in the remainder, in cps, of the second formant minus the first formant, in the production of u , in the word "shoe," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

25. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel u , in the word "shoe," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

26. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel u , in the word "shoe," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

27. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, in the production of ɛ , in the word "bench," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

28. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel ɛ , in the word "bench," for seventh and eighth grade

children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

29. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ɛ , in the word "bench," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

30. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, at the beginning, of the production of aʊ, in the word "cut," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

31. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, at the end, in the production of aʊ, in the word "out," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

32. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the diphthong aʊ , in the word "out," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

33. There are no mean differences among the E-S, A-E and M-E groups in the fundamental frequency of the diphthong aʊ, in the word "out," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

34. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, in the production of ən , in the word "and," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

35. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel ən , and the word "and," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

36. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ən , in the word "and," for seventh and

eighth grade children, with age, grade, sex, nonlanguage intelligence and socio-economic status held constant.

37. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, at the beginning, in the production of eɪ , in the word "laid," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

38. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, at the end, in the production of eɪ , in the word "laid," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

39. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the diphthong eɪ , in the word "laid," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

40. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the diphthong eɪ , in the word "laid," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

41. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, in the production of ɪ , in the word "it," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

42. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel ɪ , in the word "it," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

43. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ɪ , in the word "it," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

44. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ə , in the word "the," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

45. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel ə , in the word "the," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

46. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ə , in the word "the," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

47. There are no mean differences among the E-S, A-E, and M-E groups in the remainder, in cps, of the second formant minus the first formant, in the production of ɔ , in the word "lawn," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

48. There are no mean differences among the E-S, A-E, and M-E groups in the duration of the vowel ɔ , in the word "lawn," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

49. There are no mean differences among the E-S, A-E, and M-E groups in the fundamental frequency of the vowel ɔ , in the word "lawn," for seventh and eighth grade children, with age, grade, sex, nonlanguage intelligence, and socio-economic status held constant.

CHAPTER IV

RESULTS: READING, MECHANICS OF ENGLISH, SPELLING, PHONEMIC DISCRIMINATION, AND INFLECTION

The three groups were compared in each of the designated areas of language development. Presented in this chapter are data for each of the following variables:

1. Silent reading vocabulary
2. Silent reading comprehension
3. Total silent reading
4. Mechanics of English
5. Spelling
6. General language development
7. Oral reading accuracy
8. Oral reading comprehension
9. Phonemic discrimination
10. Articulation
11. Inflection

The following three groups were compared: Mexican children who spoke both English and Spanish when they entered kindergarten (E-S); Anglo children who spoke only English when they entered kindergarten (A-E); and Mexican children who spoke only English when they entered kindergarten (M-E).

Independent Variable Data

An analysis of variance was made for nonlanguage IQ, chronological age, and socio-economic status among the three groups of 30 subjects each. None of the F ratios reached significance (Table 4).

Also computed was a three-way analysis of covariance, with nonlanguage IQ as the covariate. Here, the F ratios for neither chronological age nor socio-economic status was significant (Table 5).

TABLE 4

Analysis of Variance of Independent Variable Data, Comparing the Three Groups*

	E-S	A-E	M-E
Mean Nonlanguage IQ			
M	100.27	103.43	104.03
SD	12.52	11.47	14.24
	F = 0.76 (not significant)		
Mean Chronological Age			
M	156.53	155.7	155.97
SD	6.83	11.21	8.9
	F = 0.06 (not significant)		
Mean Socio-Economic Status Rating			
M	4.23	3.97	3.73
SD	1.33	1.32	0.58
	F = 1.46 (not significant)		

* English-Spanish group (E-S)
Anglo-English group (A-E)
Mexican-English group (M-E)

TABLE 5

Results of Three-way Analysis of Covariance of Independent Variable Data, Comparing the Three Groups

(The covariate is nonlanguage IQ)

	E-S	A-E	M-E
Mean Chronological Age			
M	156.53	155.7	155.97
SD	6.83	11.21	8.9
	F = 0.02 (not significant)		
Mean Socio-Economic Status Rating			
M	4.23	3.97	3.73
SD	1.33	1.32	0.58
	F = 1.02 (not significant)		

Dependent Variable Data

Mean differences among the three groups were tested by means of a three-way analysis of covariance for each of the areas of language development, except articulation. Since the number of articulatory errors for each subject did not approximate a normal curve, the groups were compared, in number of articulatory errors, by means of nonparametric tests.

In each case in which the difference among groups was not significant at .05, the null hypothesis was accepted as tenable. Wherever the difference among groups was found to be significant at .05, a Duncan test was used to determine which groups differed from others.

Silent reading vocabulary. Mean scores on the California Achievement Test for silent reading for each group are shown in Table 6. The obtained score for the E-S group was the lowest and that for the A-E group was the highest. The F ratio was not significant.

Silent reading comprehension. California Achievement Test scores in silent reading comprehension differed significantly (Table 6). The E-S group mean was significantly lower than that of either of the other two groups. No significant difference was found between the A-E and M-E groups.

Total silent reading. California Achievement Test scores in silent reading vocabulary and silent reading comprehension were totaled for each subject. There was no significant difference among groups in mean total scores (Table 6).

Mechanics of English. There was a significant difference among the groups in mean California Achievement Test scores for mechanics of English (Table 7). The E-S group differed significantly from each of the other two groups. There was no significant difference between the A-E and M-E groups.

Spelling. The mean California Achievement Test score in spelling also was lower for the E-S group than for the other two groups (Table 8). The F ratio was not significant.

General language development. The groups differed significantly in mean scores of general language development (total reading scores plus spelling scores plus mechanics of English scores). The E-S group was significantly lower than each of the other two groups. There was no significant difference between the A-E and M-E groups (Table 9).

TABLE 6

Results of Three-Way Analysis of Covariance of Silent Reading Scores Comparing the Three Groups

(The covariate is nonlanguage IQ)

	E-S	A-E	M-E
Vocabulary			
M	71.9	80.27	80.4
SD	17.58	17.39	17.21
	F = 1.66 (not significant)		
Comprehension			
M	69.8	81.7	79.5
SD	15.83	20.97	12.08
	F = 3.55 (significant at .05)		
Total Silent Reading			
M	141.77	161.97	159.9
SD	31.94	35.78	26.56

Notes: Mean scores for each group are from the California Achievement Test.

Duncan test results for reading comprehension:
E-S vs. A-E (significant)
E-S vs. M-E (significant)
A-E vs. M-E (not significant)

TABLE 7

Results of Three-Way Analysis of Covariance of Mechanics of English Scores Comparing the Three Groups

(The covariate is nonlanguage IQ)

	E-S	A-E	M-E
M	73.07	86.57	84.7
SD	20.78	20.67	18.05
	F = 3.29 (significant at .05)		

Notes: Mean scores for each group are from California Achievement Test results.

Duncan Test Results:
E-S vs. A-E (significant)
E-S vs. M-E (significant)
A-E vs. M-E (not significant)

TABLE 8

Results of Three-Way Analysis of Covariance of Spelling Test Scores Comparing the Three Groups

(The covariate is nonlanguage IQ)

	E-S	A-E	M-E
M	66.57	76.3	75.63
SD	19.79	15.01	16.29
	F = 2.25 (not significant)		

Mean scores for each group are from California Achievement Test Results.

TABLE 9

Results of Three-Way Analysis of Covariance of General Language Development Scores Comparing the Three Groups

(The covariate is nonlanguage IQ)

	E-S	A-E	M-E
M	279.53	325.27	317.17
SD	68.02	63.07	55.88
	F - 3.81 (significant at .05)		

Notes: Mean scores are based on the total California Achievement Test language section scores.

Duncan Test Results

E-S vs. A-E (significant)
E-S vs. M-E (significant)
A-E vs. M-E (not significant)

Oral reading accuracy. In oral reading accuracy scores, from the Gray Oral Reading Test, the groups differred significantly. There was a significant difference between the E-S group and the other two groups. There was no significant difference between the A-E and M-E groups (Table 10).

TABLE 10

Results of Three-Way Analysis of Covariance of Oral Reading Scores Comparing the Three Groups

	E-S	A-E	M-E
Accuracy			
M	48.6	60.13	60.1
SD	20.32	15.79	13.52
	F = 3.93 (significant at .05)		
Comprehension			
M	23.87	29.8	28.2
SD	9.2	8.23	6.98
	F = 3.56 (significant at .05)		

Notes: F ratios were obtained from a three-way analysis of covariance with nonlanguage IQ as the covariate.

Duncan Test Results

Accuracy	Comprehension
E-S vs. A-E (significant)	E-S vs. A-E (significant)
E-S vs. M-E (significant)	E-S vs. M-E (significant)
A-E vs. M-E (not significant)	A-E vs. M-E (not significant)

Oral reading comprehension. Findings from the comprehension scores on the Gray Oral Reading Test were similar to those for accuracy. There was a significant difference between the E-S group and the other two groups (Table 10). There was no significant difference between the A-E and the M-E groups.

Phonemic discrimination. No significant difference was found among the groups in mean Wepman Auditory Discrimination Test scores (Table 11).

Articulation. The phonetic inventory revealed a total of 23 errors for the E-S group, one error for the A-E group, and three errors for the M-E group (Appendix, Tables 21 to 23). Fourteen of the errors for the E-S subjects were substitutions and nine were distortions. The only error of the A-E subject consisted of a distortion. One M-E subject made one substitution, while two made distortions. Substitutions occurred in the speech of five E-S subjects. Nine distortions were found among the E-S subjects. Phonemes involved in the errors of all subjects are indicated in the Appendix, Tables 21, 22 and 23.

TABLE 11

Results of Three-Way Analysis of Covariance of Phonemic Discrimination Scores Comparing the Three Groups

(The covariate is nonlanguage IQ)

	E-S	A-E	M-E
M	4.53	4.47	3.97
SD	1.52	2.16	1.32
	F = 0.85 (not significant)		

Mean differences among groups were tested by a three-way analysis of covariance with nonlanguage IQ as the covariate.

Some problems occurred in the statistical treatment of articulatory errors. Since these data did approximate a normal curve, an analysis of covariance was not considered a valid test. Chi-square was computed (Table 12). This was done by comparing subjects who made no errors with those who made one or more. The result showed a significant difference among groups. However, it should be noted that the obtained scores in two of the cells are less than five.

Since the computed chi-square is of doubtful validity, Wilcoxon Matched Pairs Signed Ranks Tests were also computed (Tables 13, 14, and 15). The difference between the E-S and A-E groups was significant at less than .01. Also, the difference between the E-S and M-E groups was significant at less than .01. There was no significant difference between the A-E and M-E groups.

Finally, the three groups were compared in mean number of articulatory errors by the Duncan test (Table 16). Here, too, there was no significant difference between the A-E and M-E groups. The E-S group was found to have significantly more errors than either.

Inflection. There was a significant difference among the groups in mean total scores as rated by the three judges. The E-S group was significantly inferior to each of the other two groups. There was no significant difference between the A-E and M-E groups (Table 17).

TABLE 12

Results of Chi-Square of Number of Articulation Errors Comparing the Three Groups

	No errors	One or more errors	Totals
E-S	(25.33) 19	(4.67) 11	30
A-E	(25.33) 29	(4.67) 1	30
M-E	(25.33) 28	(4.67) 2	30
Totals	76	14	90

$S^2 = 15.37$ (significant at less than .05)

TABLE 13

Results of Wilcoxon Matched Pairs Signed Ranks Test of Number of Articulation Errors Comparing the E-S and A-E Groups

E-S	A-E	d	d	Rank of d
1	0	1	6	10
2	0	2	5	9
5	0	5	2	7
6	0	6	2	7
1	0	1	2	7
1	0	1	1	3
1	0	1	1	3
2	0	2	1	3
2	0	2	1	3
1	0	1	1	3

N = 10

T = 0 (significant at less than .01)

TABLE 14

Results of Wilcoxon Matched Pairs signed Ranks Test of Number of Articulation Errors Comparing the E-S and M-E Groups

E-S	M-E	d	d	Rank of d
1	0	1	6	13
2	0	2	5	12
0	1	-1	2	10
5	0	5	2	10
6	0	6	2	10
1	0	1	1	4.5
1	0	1	1	-4.5
1	0	1	1	4.5
0	1	-1	1	4.5
1	0	1	1	4.5
2	0	2	1	-4.5
2	0	2	1	4.5
1	0	1	1	4.5

N = 13

T = 9 (significant at less than . 01)

TABLE 15

Results of Wilcoxon Matched Pairs Signed Ranks Test of Number of Articulation Errors Comparing the M-E and A-E Groups

M-E	A-E	d	d	Rank of d
1	0	1	1	2.5
1	0	1	1	2.5
0	1	-1	-1	-2.5
1	0	1	1	2.5

N = 4

T = 5 (not significant)

TABLE 16

Duncan Test Results of Total Number of Articulation Errors Comparing the Three Groups

E-S vs. A-E (significant)

E-S vs. M-E (significant)

A-E vs. M-E (not significant)

TABLE 17

Results of Three-Way Analysis of Covariance of Inflection Comparing the Three Groups

	E-S	A-E	M-E
M	10.73	9.9	9.67
SD	1.39	1.45	1.49

F = 4.28 (significant at .05)

Notes: Scores presented are the mean total ratings of three judges.

Duncan Test Results

E-S vs. A-E (significant)
E-S vs. M-E (significant)
A-E vs. M-E (not significant)

Summary

The three groups, English-Spanish (E-S), Anglo-English (A-E), and the Mexican-English (M-E) were compared in certain areas of language development. The groups each had the same number of boys and the same number of girls. Each had the same number of seventh grade subjects and the same number of eighth grade subjects.

Analyses of variance revealed no significant difference among the groups in nonlanguage IQ, CA, or socio-economic status rating. Three-way analyses of covariance, with nonlanguage IQ as the covariate, showed no significant differences among the groups in chronological age or socio-economic status.

The three groups were compared in all areas except articulation by means of an analysis of covariance with nonlanguage IQ as the covariate. In each case in which the F ratio was significant at .05, a Duncan test was used to determine which group differed from others. Differences in number of articulatory errors, among groups, were tested by means of the chi-square, the Wilcoxon Matched Pairs Signed Ranks Test, and the Duncan test.

There were significant differences among the groups in silent reading comprehension, mechanics of English, general language development, oral reading accuracy, oral reading comprehension, articulation, and inflection. Analyses indicated that in each of these areas there were no significant differences between the A-E and M-E groups, but that both of these groups excelled the E-S group.

There were no significant differences among groups in silent reading vocabulary, total silent reading, spelling, or phonemic discrimination.

CHAPTER V

RESULTS: SPECTOGRAPHIC DATA

In order to compare vowel production of the three groups, an attempt was made to obtain a spectogram of a speech sample from each of the 90 subjects. In a number of cases it was impossible to get a valid spectogram. Certain subjects seem to have spoken with insufficient intensity. In some of such cases, one or more formants did not show up. Thus not all of the desired measurements could be made.

The valid and legible spectograms were sorted from the others. Subjects who had acceptable spectograms were rematched with subjects from the other two groups who also had satisfactory spectograms. Thus, three groups of subjects were rematched in such a manner that there were 18 subjects in each.

Independent Variable Data

Data concerning the subjects are shown in Tables 18, 19, and 20. Analyses of variance (Table 21) showed no significant difference in nonlanguage IQ, chronological age, or socio-economic status. An analysis of covariance, with nonlanguage IQ as the covariate, was made. Neither F ratio reached significance. (Table 22)

Measurements and Treatment

As was explained in Chapter III, spectographic measurements were made, for each vowel, of the second formant minus the first formant ($F_2 - F_1$). The formants represent the resonance regions of the vowel. For the two diphthongs, the formant measurements were determined for both the inception and the termination of the diphthong. Measurements were also made of the duration and fundamental frequency of each vowel and diphthong.

Mean measurements and standard deviations were computed for each of the three groups. An analysis of covariance was made for each measurement of every vowel and diphthong tested. Nonlanguage IQ was the covariate. In each case in which the F ratio showed no significant difference among groups at .05, the null hypothesis of no significant

TABLE 18

Spectographic Study Subjects

(English-Spanish Group)

Identifying number	Nonlanguage IQ	CA	SES	Sex	Grade	School
181	120	157	4	M	8	1
182	86	161	5	F	8	1
183	121	156	7	M	8	1
184	103	159	3	F	8	1
175	110	146	5	M	7	1
177	80	164	7	M	7	1
176	109	143	4	F	7	1
2814	97	157	3	F	8	2
2816	95	151	6	F	8	2
2818	118	156	4	F	8	2
2822	97	157	3	F	8	2
2824	85	159	4	F	8	2
2826	102	160	4	F	8	2
3715	81	146	4	M	7	3
4728	108	141	2	F	7	4
3819	118	158	3	M	8	3
5725	83	164	5	M	7	5
5832	121	162	2	F	8	5

TABLE 19

Spectographic Study Subjects

(Anglo-English Group)

Identifying number	Nonlanguage IQ	CA	SES	Sex	Grade	School
1836	113	156	2	F	8	1
1838	107	155	4	F	8	1
1837	114	166	4	M	8	1
1739	110	142	4	M	7	1
1742	109	148	7	F	7	1
2846	109	158	3	F	8	2
3850	92	163	3	F	8	3
2752	106	144	3	F	7	2
3851	86	159	6	M	8	3
3854	116	166	3	F	8	3
3853	89	163	5	M	8	3
3856	113	156	5	F	8	3
5855	107	164	4	M	8	5
5757	98	146	3	M	7	5
4859	98	164	4	M	8	4
5862	84	164	6	F	8	5
5764	113	147	3	F	7	5
5766	105	150	3	F	7	5

TABLE 20

Spectographic Study Subjects

(Mexican-English Group)

Identifying number	Nonlanguage IQ	CA	SES	Sex	Grade	School
1868	95	169	4	F	8	1
1772	104	162	4	F	7	1
2876	87	165	5	F	8	2
2878	113	166	4	F	8	2
2880	109	158	4	F	8	2
2871	114	166	3	M	8	2
2884	110	160	4	F	8	2
2875	110	164	4	M	8	2
2886	108	159	3	F	8	2
3790	88	136	4	F	7	3
3879	131	157	4	M	8	3
3792	129	143	3	F	7	3
3894	114	163	3	F	8	3
5896	86	166	3	F	8	5
5785	87	144	4	M	7	5
5887	129	156	4	M	8	5
5789	97	153	4	M	7	5
5893	91	163	4	M	8	5

TABLE 21

Results of Analysis of Independent Variable Data Comparing the Three Groups of Eighteen Subjects Each

	E-S	A-E	M-E
Nonlanguage IQ			
M	101.89	103.83	105.67
SD	14.63	10.18	14.91
	F = 0.63 (not significant)		
Chronological Age			
M	155.39	156.17	158.33
SD	7.04	8.13	9.08
	F = 0.63 (not significant)		
Socio-economic Status			
M	4.17	4.0	3.78
SD	1.46	1.33	0.55
	F = 0.49 (not significant)		

TABLE 22

Results of Analysis of Covariance of Independent Variable Data Comparing the Three Groups of Eighteen Subjects Each

(Nonlanguage IQ is the covariate)

	E-S	A-E	M-E
Chronological Age			
M	155.39	156.17	158.33
SD	7.04	8.13	9.08
	F = 0.74 (not significant)		
Socio-economic Status			
M	4.17	4.0	3.78
SD	1.46	1.33	0.55
	F = 0.29 (not significant)		

difference was accepted. In each case in which a significant difference was found, a Duncan test was employed to determine which groups differed significantly from others.

Spectographic Findings

Measurements from all spectograms, together with the means, standard deviations, and F ratios are given in the Appendix, Tables 35 to 72. Information regarding findings of significant differences among groups is presented in the present section.

The formant measurements. In the comparison of the three groups as to mean difference between the first two formants, there were significant differences among groups for only three vowels (Table 23). These were O , ɛ , and I .

For the O vowel, the Duncan test showed the E-S group to differ significantly from the other two groups. There was no significant difference between the A-E and M-E groups. (Table 24)

Similarly, there was a significant difference for the vowel between the E-S group and the other two groups. There was no significant difference between the A-E and M-E groups.

For the I vowel, the M-E group differed significantly from the other two groups. There was no significant difference between the E-S and A-E groups.

Duration. There were significant differences among groups in mean duration of the eɪ diphthong and the ɔ vowel (Table 25).

For the eɪ diphthong, there was a significant difference between the E-S group and the M-E group. There was no significant difference between the E-S and A-E groups or the A-E and M-E groups. (Table 26)

For the ɔ vowel, there was a significant difference between the M-E group and the other two groups. There was no significant difference between the A-E and E-S groups.

Fundamental frequency. In mean fundamental frequency, there were significant differences among the groups for the ɛ and ʍ vowels and the aʊ diphthong (Table 27).

There was a significant difference between the E-S and M-E groups in fundamental frequency of the vowel. There was no significant difference between the A-E group and either of the other two groups. (Table 28)

TABLE 23

Results of Three-Way Analysis of Covariance of Formant Position of Vowels Comparing the Three Groups (Nonlanguage IQ is the covariate)

Vowel or Diphthong	F ratio
o	4.99*
ʊ	0.82
ɑ	0.18
ɔ	1.71
ʌ	2.31
ɛ	7.67**
əʊ (1)	0.32
aʊ (2)	0.35
ɚ	2.82
eɪ (1)	0.12
eɪ (2)	2.79
ɪ	5.82**
ə	0.86
ɔ	0.17

* significant at .05
** significant at .01

TABLE 24

Duncan Test Results of Formant Positions Comparing the Three Groups

The o vowel
- E-S vs. A-E (significant)
- E-S vs. M-E (significant)
- A-E vs. M-E (not significant)

The ɛ vowel
- E-S vs. A-E (significant)
- E-S vs. M-E (significant)
- A-E vs. M-E (not significant)

The ɪ vowel
- E-S vs. A-E (not significant)
- E-S vs. M-E (significant)
- A-E vs. M-E (significant)

TABLE 25

Results of Three-Way Analysis of Covariance of Duration of Vowels Comparing the Three Groups

(Nonlanguage IQ is the covariate)

Vowel or Diphthong	F ratio
o	1.06
ʊ	0.08
ɑ	1.87
ɔ	2.27
ʌ	1.7
ɛ	2.37
aʊ	2.74
æ	0.75
eɪ	4.37*
ɪ	1.79
ə	2.14
ɔ	8.56**

* significant at .05
** significant at .01

TABLE 26

Duncan Test Results of Duration Comparing the Three Groups

The eɪ Diphthong

E-S vs. A-E (not significant)
E-S vs. M-E (significant
A-E vs. M-E (not significant)

The ɔ vowel

E-S vs. A-E (not significant)
E-S vs. M-E (significant)
A-E vs. M-E (not significant)

TABLE 27

Results of Three-Way Analysis of Covariance of Fundamental Frequency of Vowels Comparing the Three Groups

(Nonlanguage IQ is the covariate)

Vowel or Diphthong	F ratio
o	1.69
ʊ	2.63
ɑ	0.1
ɔɪ	2.18
ʉ	1.48
ɛ	3.41*
əʊ	3.7*
ɜ	4.1*
eɪ	1.0
ɪ	1.69
ə	3.1
ɔ	1.38

*significant at .05

TABLE 28

Duncan Test Results of Fundamental Frequency Comparing the Three Groups

The ɛ Vowel
- E-S vs. A-E (not significant)
- E-S vs. M-E (significant)
- A-E vs. M-E (not significant)

The ɜ Vowel
- E-S vs. A-E (not significant)
- E-S vs. M-E (significant)
- A-E vs. M-E (significant)

The əʊ Diphthong
- E-S vs. A-E (not significant)
- E-S vs. M-E (significant)
- A-E vs. M-E (not significant)

The M-E group differed significantly from the other two groups in fundamental frequency of the æ vowel. There was no significant difference between the A-E and E-S groups.

For the aʊ diphthong, there was a significant difference in fundamental frequency between the M-E and E-S groups. There was no significant difference between the E-S and A-E groups, or between the M-E and A-E groups.

Summary

Spectographic measurements were made of ten vowels and two diphthongs spoken by the three groups of subjects. Measurements were made of the difference between the first two formants ($F_2 - F_1$), duration, and fundamental frequency. Mean differences among groups were compared by analyses of covariance with nonlanguage IQ as the covariate.

Analysis of variance indicated there was no significant difference among the groups in the independent variables.

There were significant differences among groups for the vowels o , ɛ , ɪ , ɔ , and ʌ , and for the two diphthongs. The ɛ vowel differed in $F_2 - F_1$ and fundamental frequency. The o and ɪ vowels differed in $F_2 - F_1$. The ɔɪ diphthong and the ɜ vowel differed in duration.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the present investigation was to study the linguistic functioning of children of a certain language-cultural environment. Specifically, it dealt with Mexican children who had spoken both Spanish and English when they enrolled in kindergarten.

Children of this environment (E-S) were compared with Anglo children who had always spoken only English (A-E). These two groups were also compared with Mexican children who had always spoken only English, but whose parents spoke both Spanish and English (M-E).

Thirty subjects were selected from each of the three classifications in such a manner that there were no statistically significant differences among the groups in nonlanguage intelligence, chronological age, grade, sex, or socio-economic status.

The groups were compared in the areas of silent reading vocabulary, silent reading comprehension, total silent reading, mechanics of English, spelling, general or total language development, oral reading accuracy, oral reading comprehension, phonemic discrimination, articulation, and inflection.

Eighteen subjects from each group were rematched in such a manner that there were no significant differences among groups in the independent variables. The groups were then compared in the production of ten selected vowels and two diphthongs. Dimensions of the vowels and diphthongs compared were position of the first two resonance regions ($F_2 - F_1$), duration, and fundamental frequency.

Findings in Terms of Null Hypotheses

The null hypotheses tested in the present study are stated in Chapter III, pages 57-69. The first eleven of these were tested by means of data from all 30 subjects in each of the three groups. The remaining 38 null hypotheses, dealing with vowel and diphthong production, were tested by means of spectographic data. Data were obtained

from 18 subjects in each of the three groups to test the last 38 hypotheses. Results, in terms of the 49 null hypotheses are summarized in the present section.

Achievement in reading, mechanics of English, and spelling. Of the first eight null hypotheses, the first, third, and fifth were found to be tenable. There were no significant differences among groups in silent reading vocabulary, total silent reading, spelling, or phonemic discrimination.

Rejected were the second, fourth, sixth, and seventh, and eighth null hypotheses. Significant differences among groups were found in silent reading comprehension, mechanics of English, general language development, oral reading accuracy, and oral reading comprehension. In each case, there was no significant difference between the A-E and M-E groups. The difference was significant between the E-S group and each of the other two groups.

Achievement in phonemic discrimination, consonant articulation, and inflection. The ninth null hypothesis was found to be tenable. There was no significant difference among groups in ability to discriminate English phonemes.

The tenth and eleventh null hypotheses were rejected. The E-S group made significantly more errors in consonant articulation than did the A-E and M-E groups. There was no significant difference in number of articulation errors between the A-E and M-E groups. Also, the A-E and M-E groups did significantly better in inflection than did the E-S group. There was no significant difference between the A-E and M-E groups.

Vowel production. Of the remaining 38 null hypotheses, 30 were tenable. Rejected were null hypotheses numbered 12, 27, 29, 33, 36, 39, 41, and 49.

There was a significant difference among groups in the $F_2 - F_1$ measurements of the vowel O. Thus the twelfth null hypothesis was rejected. The score for the E-S group was significantly greater than for either of the other two groups. No significant difference was found between the A-E and M-E groups.

Null hypothesis number 27 was rejected. There was a significant difference between the E-S group and the other two groups in the $F_2 - F_1$ scores of the vowel ϵ. There was no significant difference between the A-E and M-E groups.

There was also a significant difference among groups in the fundamental frequency of the vowel ∂U. Null hypothesis number 29 was rejected. Here, however,

the significant difference was between the E-S and M-E groups. There was no significant difference between the E-S and A-E groups.

There was a significant difference among groups in fundamental frequency of the diphthong /əʊ/. Null hypothesis number 33 was rejected. The E-S group differed significantly from the M-E group but not from the A-E group. There was no significant difference between the A-E and M-E groups.

A significant difference was found between the E-S group and each of the other groups in fundamental frequency of the vowel /ɒ/. Null hypothesis number 36 was rejected. There was no significant difference between the A-E and M-E groups.

In duration of the diphthong /eɪ/, the E-S group differed significantly from the M-E group only. Null hypothesis number 39 was rejected. Duration was shortest for the E-S group. There was no significant difference between the E-S and A-E groups or between the A-E and M-E groups.

Null hypothesis number 41 was rejected. There was a significant difference among groups in the $F_2 - F_1$ measurements of the vowel /ɪ/. Here the M-E group differed significantly from both of the other groups. There was no significant difference between the A-E and E-S groups.

There was a significant difference among groups in the duration of the vowel /ɔ/. Null hypothesis number 48 was rejected. Duration was significantly shorter for the M-E group than for either of the other groups. There was no significant difference between the E-S and A-E groups.

Discussion

It appears that in certain areas of linguistic functioning, the children who spoke only English when they entered kindergarten excel Mexican-American children who learned both English and Spanish before entering kindergarten.

This is in accordance with earlier research which seemed to indicate that monolinguals excelled bilinguals in linguistic functioning. Findings of the present study are also comparable to those of more recent investigations, as in Carrow's study (8). In the present investigation, as in Carrow's, no significant differences were found in silent reading vocabulary or spelling. The present investigator, like Carrow, found significant differences in oral reading accuracy, oral reading

comprehension, and articulation. Carrow, whose study was done with third-grade subjects, suggested that a study done at a higher grade level might reveal that children who spoke only one language would excel in reading vocabulary those who learned two languages simultaneously. The present study failed to find such a difference. The present investigation did, however, reveal a significant difference in favor of the one-language subjects in silent reading comprehension, whereas Carrow's did not.

Findings of the present study suggest that the language handicap of Mexican children who learn two languages before starting to school does not diminish as the child matures and progresses in school. When reading comprehension is considered, it appears that the language handicap might become more in evidence. This is not in accordance with the conclusions which might be drawn from the studies of Black and Grinder (4) and Spoerl (33) which were done with college student subjects.

While the Wepman Test results of the present study cannot be said to demonstrate conclusively that the E-S children discriminate English phonemes as well as children who have always spoken only English, it appears that the poorer articulation of the Spanish-speaking children cannot be accounted for wholly by their failure to discriminate auditorially. It may be that the muscles of the speech organs are trained in faulty habits at an early age. As Lynn (21) suggests, it may be due to the use of Spanish from babyhood and attempting to learn a second set of habits before an earlier set is well established.

The present study failed to reveal that the vowels of the E-S children were consistently shorter than those of the other subjects. Lynn (21) found that all vowels of Mexican-English were shorter than the corresponding General-American vowels. It is quite possible that a spectographic survey of a large number of Mexican-American speakers, over a wide area, would reveal that their vowels are indeed of shorter duration. Present data suggest, however, that E-S children, in this particular setting, seem to produce vowels of comparable length to those of other children who are like them in age, sex, grade, nonlanguage intelligence, and socio-economic status.

A question arises as to why for certain vowel measurements, the M-E group, and the A-E group did not differ significantly from either. This was true for the fundamental frequency of the vowel ɛ and the diphthong əʊ. It was also true for the duration of the diphthong eɪ. More important, for certain measurements, the

M-E deviated significantly from both the A-E and E-S groups, while there was no significant difference between the A-E and E-S groups. This was true in the case of the $F_2 - F_1$ measurement of the vowel I and of the duration of the vowel) . No significant difference was found between the A-E and E-S groups. These results could possibly be due to Type I errors. This cannot, of course, be assumed. It appears from the present study that M-E children, as defined, differ in the production of certain vowels.

Any explanation of the results discussed in the foregoing paragraph is speculative. It may be that they reflect an occasional "hypercorrect" characteristic of people who have worked diligently to overcome a foreign dialect and have gone to extremes. This characteristic may be like that of the speech of a foreign speaker who has at last learned not to say hum for hom ("home"), and now says tol for tul ("tool"). In any case, it is suggested that not all speech and language problems are overcome by emphasizing to foreign parents that they should teach their children only English at the outset.

Conclusions

The present study, considered in the light of other research, seems to support several general conclusions in regard to the linguistic functioning of seventh and eighth grade children of the language-cultural environment under investigation.

It should be emphasized that the investigation was conducted in three communities in which the Mexican-American population constitutes a small minority. Conclusions drawn may not apply to Mexican children in communities in which a much larger percentage of the people are Mexican, or where there are enighborhoods which are populated almost entirely by Mexicans. In the present setting, there would be expected more mixing of Mexican and Anglo children in the neighborhood and in school. Thus there is probably more acculturation of Mexican children than in much of the Southwest. It is believed that the present study was justified because similar results might be expected in many other communities of which the present situation seems typical. A few cautious generalizations may be made with this in mind.

1. Children taught only English before kindergarten excel Mexican children using both Spanish and English, in silent reading comprehension, mechanics of English,

in silent reading comprehension, mechanics of English, general language development, oral reading accuracy, and oral reading comprehension.

2. Mexican children who were taught both Spanish and English before entering kindergarten are more prone to have defective articulation than are those taught only English. It is, therefore, tentatively concluded that the inferiority in linguistic functioning of the children who spoke both Spanish and English is due to a conflict of early language habits.

3. The inflection of Mexican children, who spoke both Spanish and English before entering kindergarten, differs from those who spoke only English. This lends some support to Van Riper's contention that perhaps the hardest of all foreign-dialect characteristics to eradicate is the inflectional pattern.

4. There appears to be a difference in the production of a few English vowels between Mexican children who learned Spanish and English before entering kindergarten and those who have spoken only English. It also appears, however, that children whose Spanish-speaking parents have taught them only English produce certain vowels differently from General-American vowels. Whether or not more of such differences would be revealed if the same vowels were used in other contexts is not known from the present study.

Recommendations

In view of the foregoing conclusions, a few recommendations may be in order.

Educational implications. First, school personnel need to be made aware of the special language problems of children of this two-language cultural environment.

Second, consideration should be given to providing a special program in language training to these children who manifest a language handicap. For such children, this should begin at the kindergarten level. It might well start with speech stimulation and language development and should be followed with training in the production of both vowels and consonants.

There is a practice in the schools to forego speech correction for kindergarten children until they are older. The reason is that often the kindergarten child's speech "defect" is really quite normal (that is, "common") for his age, or at any rate may vanish by the time he is six or seven years old. It appears, however, that many

children who speak both Spanish and English when they enter kindergarten do not overcome their articulatory defects. Also, the delay in other areas of language development continues as they advance in school. It is recommended, then, that special help be provided in kindergarten.

Third, in the elementary grades, special attention should be given to these children in vocabulary development, reading, and mechanics of English. Included also should be articulatory correction, wherever necessary, and training in inflection.

Fourth, if the results of this study are replicated, and if it is important to preclude some of the problems revealed here in children with a two-language background, then it may be suggested that Mexican-American parents should teach their children only English until they have completed the early elementary grades. It is, of course, uncertain as to how much this type of child's difficulty is due to his knowing two languages and how much it is due to other ethnic variables in the home environment.

Suggestions for further research. Despite strides in recent years, there are still more unanswered questions about problems of partially-acculturated Mexican-American children than factual information.

The linguistic functioning of children who speak both Spanish and English and who live in a solidly Mexican-American neighborhood might well be compared with that of Mexican-Americans in the same environment who speak only English. A similar comparison should be made among subjects in the higher IQ brackets. Research along such lines should be undertaken with carefully matched groups of subjects, even though only small groups were available. Such investigations might provide a basis for determining at what age, or mental age, a child should ordinarily begin learning a second language.

Finally, further surveying should be done of characteristics of the Mexican-American culture. Included should be living habits, child-rearing practices, amount and nature of the formal education of the parents, and no doubt many other factors. Findings of past studies of "bilingualism," as well as results of the present study, cannot be attributed solely to language background, but rather to total language-cultural environment. The factors which constitute this environment need to be determined.

TABLE 29

Warner, Meeker, and Eells Revised Scale for Rating Occupations*

Rating assigned to occupation	Professionals	Proprietors and Managers	Business Men	Clerks and Kindred Workers	Manual Workers	Protective and Service Workers	Farmers
1	Lawyers, doctors, dentists, engineers, judges, high school superintendents, veterinarians, ministers (graduates of divinity schools), chemists, etc., with postgraduate training, architects	Businesses valued at $75,000 and more	Regional and divisional managers of large financial and industrial enterprises	Certified Public Accountants			Gentlemen Farmers
2	High school teachers, trained nurses, chiropodists, chiropractors, undertakers, ministers (some training), news editors, librarians (graduate)	Businesses valued at $20,000 to $75,000	Assistant managers, office-department managers of large businesses, assistants to executives	Accountants, salesmen of real estate, salesmen of insurance, postmasters			Large-farm owners, farm owners
3	Social workers, grade school teachers, optometrists, librarians (not graduate), undertaker's assistants, ministers (no training)	Businesses valued at $5,000 to $20,000	All minor officials of businesses	Auto salesmen, bank clerks, secretaries to executives, Cashiers, postal clerks railroad supervisors, telephone supervisors, justices of the peace	Contractors		

(continued)

Table 29 continued

Rating assigned to occupation	Professionals	Proprietors and Managers	Business Men	Clerks and Kindred Workers	Manual Workers	Protective and Service Workers	Farmers
4		Businesses valued at $2,000 to $5,000		Stenographers, bookkeepers, rural mail clerks, ticket agents, salespersons in retail stores, etc.	Factory foremen, electricians, plumbers, carpenters, watchmakers, own business	Dry cleaners, butchers, sheriffs, railroad engineers and conductors	
5		Businesses valued at $500 to $2,000		Dime store clerks, hardware salesmen, beauty operators, telephone operators	Carpenter's apprentices, electricians, timekeepers, lineman repairmen, medium-skill jobs	Barbers, firemen, practical nurses, policemen, cooks in restaurants, bartenders	Tenant farmers
6		Businesses valued at less than $500			Moulders, semiskilled workers, assistants to carpenters, electricians, plumbers, etc.	Baggage men, night policemen, watchmen, taxi, truck drivers, gas station attendants, waitresses in restaurants	Small tenant farmers

(continued)

Table 29 continued

Rating assigned to occupation	Professionals	Proprietors and Managers	Business Men	Clerks and Kindred Workers	Manual Workers	Protective and Service Workers	Farmers
7					Heavy laborers, migrant workers, odd-job men, miners	Janitors, scrub-women, news-boys	Migrant farm laborers

* W. Warner, M. Meeker, and K. Eells, Social Class in America (Chicago: Science Research Associates, Inc., 1949), pp. 140-141.

TABLE 30

California Achievement Test Junior High Level

(Reliability Coefficients)*

Variable	Reliability Coefficient	Mean	Standard error of Measurement
Reading Vocabulary	.90	36.8	3.5
Reading Comprehension	.92	48.7	4.3
Total Reading	.95		
Mechanics of English	.92	69.9	4.3
Spelling	.83	18.5	2.5
Total Language	.93		

* Source: Tiegs, E. and Clark, W., Manual of the California achievement tests complete battery, junior high level. L.A.: California Test Bureau, 1957.

These data were obtained using the Kuder-Richardson formula.

TABLE 31

Silent Reading Vocabulary

E-S	A-E	M-E
110	100	103
64	60	82
100	107	90
63	78	75
56	84	69
41	77	74
75	52	70
60	75	92
82	68	75
74	60	54
107	75	88
65	96	107
61	108	94
78	47	86
69	67	96
88	115	63
75	54	59
68	76	37
63	92	92
54	102	99
34	77	65
90	72	84
74	88	74
90	80	108
86	65	84
69	84	103
68	75	52
47	102	86
78	90	74
68	82	77
M = 71.9	M = 80.267	M = 80.4
SD = 17.584	SD = 17.388	SD = 17.212

F = 1.664 (not significant)

TABLE 32

Silent Reading Comprehension

E-S	A-E	M-E
98	116	84
60	78	69
103	107	89
59	82	73
61	84	66
57	81	64
60	52	63
57	63	73
74	65	71
62	54	75
86	86	92
68	75	71
68	102	84
71	69	82
62	71	98
71	138	58
64	62	79
68	63	57
58	69	86
45	124	84
33	78	78
88	81	99
59	66	81
102	78	95
84	77	81
82	112	102
80	59	70
69	80	92
81	99	78
64	80	91
M = 69.8	M = 81.7	M = 79.5
SD = 15.83	SD = 20.97	SD = 12.08

F = 3.55 (significant at .05)

TABLE 33

Silent Reading--Total

E-S	A-E	M-E
208	116	187
124	78	151
203	107	179
122	82	148
117	84	135
98	81	138
135	52	133
117	63	165
156	65	146
136	54	129
193	86	180
133	75	178
129	102	178
149	69	168
131	71	194
159	138	121
139	62	138
136	63	94
121	69	178
99	124	183
67	78	143
178	81	183
133	66	155
194	78	203
170	77	165
151	112	205
148	59	122
116	80	178
159	99	152
132	80	168
M = 141.77	M = 161.97	M = 159.9
SD = 31.94	SD = 35.78	SD = 26.56

F = 292 (not significant)

TABLE 34

Mechanics of English

E-S	A-E	M-E
104	91	98
77	80	47
89	111	104
69	85	81
54	98	61
42	66	84
74	38	80
49	93	88
74	76	102
49	40	59
115	90	85
52	88	82
65	115	97
82	71	90
78	85	105
82	128	52
71	63	70
88	80	46
65	102	104
38	102	82
32	54	102
88	104	89
62	90	95
90	80	111
104	80	89
88	94	104
80	89	63
68	105	85
105	113	97
58	86	89
M = 73.07	M = 86.57	M = 84.7
SD = 20.78	SD = 20.61	SD = 18.05

F = 3.29 (significant at .05)

TABLE 35

Spelling

E-S	A-E	M-E
100	75	88
67	75	58
96	83	96
34	96	96
54	100	60
36	40	63
86	65	72
51	79	75
60	67	69
54	51	54
102	58	63
55	75	83
58	86	88
85	78	96
72	54	96
86	86	40
54	63	69
69	75	43
60	72	86
44	106	75
32	75	58
79	75	86
54	83	60
79	86	92
79	86	96
88	72	88
86	72	60
54	88	92
79	102	79
44	65	88
M = 66.57	M = 76.3	M = 75.63
SD = 19.79	SD = 15.01	SD = 16.29

F = 2.25 (not significant)

TABLE 36

General Language Development

E-S	A-E	M-E
412	382	373
268	293	256
388	408	284
225	341	325
225	366	256
176	264	285
295	207	280
217	310	328
290	276	317
235	205	242
410	309	328
240	334	343
252	411	363
316	265	354
281	277	395
327	467	213
264	242	277
261	294	183
246	345	368
181	434	340
131	284	301
345	332	358
259	327	310
363	324	416
353	308	350
327	362	397
314	295	245
238	378	355
313	405	328
234	313	345
M = 279.53	M = 325.27	M = 317.17
SD = 68.02	SD = 63.07	SD = 55.88

F = 3.81 (significant at .05)

TABLE 37

Oral Reading Accuracy

E-S	A-E	M-E
83	62	92
54	58	55
79	82	81
45	66	62
28	44	36
18	61	55
53	54	69
24	67	62
77	53	44
65	37	58
80	63	67
46	70	67
30	81	66
66	16	66
60	43	72
60	70	52
33	60	49
60	57	52
68	40	76
25	79	76
16	77	35
22	63	55
26	87	39
57	59	49
54	42	77
17	68	69
53	58	50
46	76	57
60	70	64
53	41	51
M = 48.6	M = 60.13	M = 60.1
SD = 20.32	SD = 15.79	SD = 13.52

F = 3.93 (significant at .05)

TABLE 38

Oral Reading Comprehension

E-S	A-E	M-E
41	34	38
26	31	36
29	40	33
29	32	27
18	39	21
20	32	36
29	25	36
16	24	26
36	28	26
29	22	24
30	30	34
20	32	34
19	30	29
28	12	32
22	22	31
29	44	25
18	28	20
24	27	35
28	12	34
12	39	38
12	39	14
12	31	16
25	26	16
30	26	21
22	19	33
2	34	32
23	38	25
22	41	24
48	30	30
27	17	20
M = 23.87	M = 29.8	M = 28.2
SD = 9.2	SD = 8.23	SD = 6.98

F = 3.56 (significant at .05)

TABLE 39

Phonemic Discrimination

E -S	A-E	M-E
4	5	2
3	3	6
4	2	3
5	6	7
6	6	4
8	6	3
4	9	2
4	7	4
5	7	3
6	9	4
2	8	7
4	2	3
6	3	3
5	4	3
4	5	2
3	3	5
5	4	4
3	3	3
2	4	3
5	3	3
7	3	4
6	0	5
4	5	5
6	6	5
3	3	5
4	5	3
2	3	4
5	2	5
7	5	5
4	3	4
M = 4.53 SD = 1.52	M = 4.47 SD = 2.16	M = 3.97 SD = 1.32

F = 0.85 (not significant)

TABLE 40

Articulation Errors: E-S

Substitutions	Distortions	Total
0	1	1
0	2	2
0	0	0
0	0	0
4	1	5
5	1	6
0	0	0
0	0	0
0	1	1
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	1	1
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	1	1
0	0	0
0	1	1
0	0	0
0	0	0
2	0	2
2	0	2
0	0	0
1	0	1
Totals 14	9	23

TABLE 41

Articulation Errors: A-E

	Substitutions	Distortions	Total
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	1	1
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
Totals	0	1	1

TABLE 42

Articulation Errors: M-E

	Substitutions	Distortions	Total
	0	0	0
	0	0	0
	1	0	1
	0	1	1
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	1	1
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
Totals	1	2	3

TABLE 43

Inflection

E-S	A-E	M-E
9	6	9
11	9	9
9	9	11
11	9	12
8	9	10
11	10	9
9	9	9
12	9	12
8	10	11
11	9	6
12	12	9
9	9	9
12	12	9
12	9	9
12	9	9
12	12	9
12	9	12
12	9	10
9	10	11
10	11	12
10	11	10
11	12	9
11	11	10
12	9	10
11	10	8
12	8	8
11	10	12
13	11	9
9	12	10
11	12	7
M = 10.73	M = 9.9	M = 9.67
SD = 1.39	SD = 1.45	SD = 1.49

F = 4.28 (significant at .05)

TABLE 44

Spectographic Study: Vowel: O

$(F_2 - F_1)$

E-S	A-E	M-E
650	445	370
450	430	450
800	420	415
350	530	500
750	400	410
800	455	410
440	450	390
700	495	505
440	500	450
400	505	400
450	300	530
470	470	450
460	425	460
450	400	495
420	490	400
450	380	440
550	480	440
540	620	400
M = 531.67	M = 455.28	M = 416.94
SD = 143.41	SD = 68.44	SD = 113.09

F = 4.99 (significant at .05)

TABLE 45

Spectographic Study: Vowel: O

(Duration)

E-S	A-E	M-E
170	200	200
180	200	200
100	190	165
220	180	160
220	160	150
200	200	130
140	160	200
150	150	200
100	150	180
100	200	120
100	170	150
170	170	170
120	170	190
130	230	155
190	160	170
220	170	150
180	190	210
200	160	160
M = 160.56	M = 178.33	M = 162.78
SD = 44.26	SD = 21.76	SD = 47.16

F = 1.06 (not significant)

TABLE 46

Spectographic Study: Vowel: O

(Fundamental Frequency)

E-S	A-E	M-E
200	240	200
220	220	220
220	200	220
240	220	200
220	220	200
200	220	200
220	240	180
220	220	200
220	180	200
200	220	220
200	240	240
220	200	240
220	220	200
200	200	220
210	200	200
200	280	200
140	220	200
220	240	180
M = 209.44	M - 215.56	M = 195.56
SD = 20.71	SD = 18.85	SD = 51.59

F = 1.69 (not significant)

TABLE 47

Spectographic Study: Vowel: u

$(F_2 - F_1)$

E-S	A-E	M-E
780	740	700
1100	700	660
950	1150	440
600	450	800
950	800	1000
850	861	750
450	600	650
620	590	700
670	800	700
550	600	750
700	700	700
520	700	700
1100	750	690
600	730	710
510	700	700
470	610	700
840	700	680
810	900	650
M = 737.2	M = 726.67	M = 662.78
SD = 200.35	SD = 150.1	SD = 194.39

F = 0.817 (not significant)

TABLE 48

Spectographic Study: Vowel: U

(Duration)

E-S	A-E	M-E
120	190	55
90	70	70
150	130	180
120	140	105
100	100	90
150	100	90
60	120	110
60	130	100
120	100	130
165	150	130
60	120	170
60	100	120
110	50	100
80	70	120
60	130	130
120	50	80
150	100	150
150	100	120
M = 106.94	M = 108.33	M = 103.33
SD = 37.22	SD = 35.36	SD = 39.89

F = 0.085 (not significant)

TABLE 49

Spectographic Study: Vowel: U

(Fundamental Frequency)

E-S	A-E	M-E
180	210	200
200	200	200
220	160	200
220	200	180
220	180	180
200	180	180
220	220	160
220	180	200
240	160	220
220	140	180
200	200	220
200	160	200
200	200	180
200	180	200
200	180	180
200	160	180
160	220	180
180	220	180
M = 204.44	M = 186.11	M = 180.0
SD = 18.86	SD = 24.04	SD = 47.53

F = 2.63 (not significant)

TABLE 50

Spectographic Study: Vowel: a

$(F_2 - F_1)$

E-S	A-E	M-E
300	500	440
400	500	400
550	470	440
400	400	490
500	420	500
640	500	430
540	560	430
530	400	500
310	420	700
430	455	460
630	400	550
550	420	425
400	495	510
770	420	440
450	700	450
500	480	650
440	800	420
410	700	440
M = 486.00	M = 502.22	M = 481.94
SD = 118.48	SD = 116.94	SD = 80.31

F = 0.177 (not significant)

TABLE 51

Spectographic Study: Vowel: a

(Duration)

E-S	A-E	M-E
100	500	440
180	500	400
150	470	440
180	400	490
200	420	500
180	500	430
170	560	430
190	400	500
120	420	700
120	455	460
90	400	550
170	420	425
140	495	510
120	420	440
130	700	450
130	480	650
130	800	420
180	700	440
M = 148.89	M = 164.44	M = 161.11
SD = 33.06	SD = 22.55	SD = 23.98

F = 1.87 (not significant)

TABLE 52

Spectographic Study: Vowel: a

(Fundamental Frequency)

E-S	A-E	M-E
200	220	180
220	220	180
200	200	180
240	200	190
220	200	150
200	180	140
220	200	170
220	220	150
220	160	130
200	200	190
180	180	150
180	180	130
200	220	200
180	200	170
200	200	150
180	200	120
140	240	180
240	220	140
M = 202.22	M = 202.22	M = 201.11
SD = 24.63	SD = 19.27	SD = 21.11

F = 0.097 (not significant)

TABLE 53

Spectographic Study: Vowel: ऋ

$(F_2 - F_1)$

E-S	A-E	M-E
1000	440	1100
1080	400	1000
850	440	1100
700	490	1200
1010	500	1350
1090	430	1000
490	430	900
670	500	500
680	700	1060
700	460	600
420	550	740
900	425	880
700	510	840
700	440	1100
790	450	950
920	650	700
1000	420	720
690	440	900
M = 799.44	M = 924.44	M = 831.94
SD = 193.65	SD = 217.18	SD = 227.67
	F = 1.71 (not significant)	

TABLE 54

Spectographic Study: Vowel: ञ

(Duration)

E-S	A-E	M-E
120	90	150
70	160	120
120	120	130
140	140	120
100	180	150
170	110	130
100	150	140
100	130	100
90	130	140
120	130	130
90	110	160
140	140	120
150	150	120
150	140	p30
110	180	160
120	120	130
150	170	120
150	110	120
M = 121.67	M = 131.67	M = 136.67
SD = 27.06	SD = 15.81	SD = 25.2

F = 2.27 (not significant)

TABLE 55

Spectographic Study: Vowel: ɔ

(Fundamental Frequency)

E-S	A-E	M-E
180	200	180
180	180	180
200	180	180
220	140	200
220	160	180
200	180	140
200	180	180
200	180	200
200	220	140
220	180	180
180	200	180
180	180	160
180	180	180
200	180	180
180	160	160
160	200	180
120	180	220
220	180	200
M = 191.11	M = 178.89	M = 181.11
SD = 24.94	SD = 19.97	SD = 17.45

F = 2.18 (not significant)

TABLE 56

Spectographic Study: Vowel: ʊ

$(F_2 - F_1)$

E-S	A-E	M-E
950	590	550
1030	720	505
445	540	510
600	800	600
1160	600	595
450	500	500
650	1000	550
650	850	540
695	550	540
550	450	545
700	730	600
490	620	630
550	500	595
600	520	620
700	505	505
490	405	700
840	570	500
500	450	500
M = 669.44	M = 605.56	M = 560.28
SD = 204.59	SD = 157.03	SD = 56.53

F = 2.31 (not significant)

TABLE 57

Spectographic Study: Vowel: u

(Duration)

E-S	A-E	M-E
200	210	140
150	230	160
130	140	150
120	120	200
150	100	120
100	150	130
120	170	130
70	120	90
180	140	130
100	130	100
80	200	130
140	160	130
100	180	220
170	200	110
130	180	200
170	130	130
150	120	100
300	270	120
M = 142.22	M = 163.89	M = 138.33
SD = 52.64	SD = 45.0	SD = 36.01

F = 1.7 (not significant)

TABLE 58

Spectographic Study: Vowel: ʊ

(Fundamental Frequency)

E-S	A-E	M-E
200	240	220
200	220	180
220	200	200
200	200	200
200	220	200
200	200	200
180	180	180
220	200	180
240	180	240
220	200	200
220	200	240
200	200	180
220	220	200
220	200	220
200	200	180
240	200	200
140	220	220
240	200	140
M = 208.89	M = 204.44	M = 198.89
SD = 23.98	SD = 14.64	SD = 24.23

F = 1.48 (not significant)

TABLE 59

Spectographic Study: Vowel: ɛ

$(F_2 - F_1)$

E-S	A-E	M-E
950	1550	930
950	1050	1360
1100	1160	1250
1050	1150	1250
900	1350	1280
990	1000	1300
800	1025	1400
1050	1000	1160
1040	1300	1080
850	1440	1000
1250	1150	1250
800	1200	1300
951	1600	1300
900	1050	1300
1095	1000	950
1010	800	1250
950	1000	1250
1300	890	1340
M = 996.39	M = 1150.83	M = 1219.44
SD = 135.17	SD = 220.62	SD = 139.05

F = 7.67 (significant at less than .01)

TABLE 60

Spectographic Study: Vowel: ɛ

(Duration)

E-S	A-E	M-E
140	180	140
140	150	130
130	180	130
120	200	130
150	140	100
150	150	100
170	140	180
90	120	140
100	140	160
100	150	190
90	150	130
100	140	130
130	170	180
170	150	170
120	160	160
135	160	120
170	120	125
200	150	100
M = 133.61	M = 153.78	M = 139.72
SD = 31.24	SD = 20.54	SD = 27.0

F = 2.37 (not significant

TABLE 61

Spectographic Study: Vowel: ɛ

(Fundamental Frequency)

E-S	A-E	M-E
220	210	220
200	220	180
220	200	180
200	180	200
200	210	180
200	200	200
180	200	200
220	180	160
160	160	200
200	180	180
220	180	220
180	180	160
220	200	180
200	180	200
200	180	160
200	180	180
160	200	200
220	200	160
M = 200.0	M = 191.11	M = 186.67
SD = 19.4	SD = 15.3	SD = 19.4

F = 3.41 (significant at .05)

TABLE 62

Spectographic Study: Diphthong: əʊ

$(F_2 - F_1)$

(Inception)

E-S	A-E	M-E
850	390	500
860	510	390
900	515	600
600	750	600
300	700	690
210	1000	800
450	850	350
830	760	540
700	535	500
800	550	750
550	550	750
800	760	950
400	600	535
450	550	550
590	700	590
640	650	720
720	500	560
810	450	500
M = 636.67	M = 628.89	M = 604.17
SD = 207.02	SD = 154.79	SD = 149.18

F = 0.32 (not significant)

TABLE 63

Spectographic Study: Diphthong: ɔʊ

$(F_2 - F_1)$

(Termination)

E-S	A-E	M-E
760	400	490
930	450	390
710	700	600
490	740	900
350	450	700
350	1080	490
310	450	500
1000	800	550
650	450	600
500	600	700
650	650	500
640	800	910
500	400	510
510	500	580
600	590	410
520	850	560
590	800	600
445	500	400
M = 583.61	M = 622.78	M = 577.22
SD = 186.01	SD = 191.86	SD = 148.28

F = 0.35 (not significant)

TABLE 64

Spectographic Study: Diphthong: əʊ

(Duration)

E-S	A-E	M-E
220	150	250
180	210	180
200	220	200
100	240	235
200	150	150
200	170	130
200	200	200
140	140	200
190	180	200
150	180	280
140	230	170
170	220	210
200	230	200
200	220	190
150	105	170
190	250	200
160	150	210
150	220	230
M = 174.44	M = 192.5	M = 200.28
SD = 31.1	SD = 40.88	SD = 35.08

F = 2.74 (not significant)

TABLE 65

Spectographic Study: Diphthong: aʊ

(Fundamental Frequency)

E-S	A-E	M-E
220	200	220
200	200	180
200	180	180
200	200	180
220	200	180
200	200	180
180	200	180
200	180	180
200	160	120
210	180	220
200	200	200
200	180	200
180	200	180
220	160	200
200	140	180
200	160	180
140	200	180
220	220	140
M = 199.44	M = 186.67	M = 182.22
SD = 18.93	SD = 20.58	SD = 23.65

F = 3.7 (significant at .05)

TABLE 66

Spectographic Study: Vowel: æ

$(F_2 - F_1)$

E-S	A-E	M-E
900	1300	940
1150	1000	1010
1180	800	1120
520	1190	1000
670	340	510
580	1140	950
500	1230	690
850	1300	1060
950	1150	860
650	700	1180
480	900	1050
890	1000	1160
650	1050	1100
750	650	900
630	880	950
400	1150	740
910	500	1050
1200	505	650
M = 770.0	M = 932.5	M = 940.0
SD = 247.15	SD = 293.22	SD = 186.42

F = 2.82 (not significant)

TABLE 67

Spectographic Study: Vowel: ɑl

(Duration)

E-S	A-E	M-E
140	120	130
100	180	130
140	120	140
90	120	130
140	100	150
180	110	190
120	110	140
70	60	105
50	100	190
100	130	180
80	110	90
60	120	90
100	110	120
120	90	100
120	130	80
200	150	120
90	120	100
90	180	80
M = 110.56	M = 120.0	M = 125.83
SD = 39.18	SD = 20.7	SD = 34.99

F = 0.75 (not significant)

TABLE 68

Spectographic Study: Vowel: ɛ

(Fundamental Frequency)

E-S	A-E	M-E
200	200	200
200	180	180
200	180	180
200	160	160
220	180	180
200	200	200
180	160	180
200	180	160
200	180	200
200	180	200
180	160	200
200	180	180
200	220	180
180	160	180
180	160	180
200	180	140
160	200	180
180	200	120
M = 193.33	M = 181.11	M = 177.78
SD = 13.72	SD = 17.45	SD = 21.57

F = 4.1 (significant at .05)

TABLE 69

Spectographic Study: Diphthong: eɪ

$(F_2 - F_1)$

(Inception)

E-S	A-E	M-E
900	700	450
650	400	680
500	750	450
700	1010	745
500	400	450
400	1070	510
600	910	500
700	700	500
910	500	450
700	700	700
460	900	650
450	650	790
600	545	900
400	560	650
580	320	800
495	950	850
490	300	650
1050	390	850
M = 615.83	M = 653.06	M = 643.06
SD = 185.06	SD = 243.63	SD = 157.32

F = 0.12 (not significant)

TABLE 70

Spectographic Study: Diphthong: eɪ

$(F_2 - F_1)$

(Termination)

E-S	A-E	M-E
1010	990	700
615	750	920
520	1000	750
400	1200	1400
750	500	670
500	1400	920
700	1190	850
790	910	680
1190	460	1000
980	1100	1040
545	1250	850
700	460	1105
680	900	1500
650	870	1200
800	950	1600
610	760	1000
900	700	1000
1500	600	750
M = 768.89	M = 888.33	M = 996.39
SD = 269.47	SD = 279.18	SD = 277.22

F = 2.79 (not significant)

TABLE 71

Spectographic Study: Diphthong: eI

(Duration)

E-S	A-E	M-E
160	130	140
150	130	170
120	200	170
220	200	230
120	130	190
200	220	120
180	150	250
100	140	170
135	190	250
150	230	180
110	250	220
200	200	230
180	130	230
120	200	160
190	220	200
120	180	220
210	130	230
200	220	220
M = 159.17	M = 180.56	M = 198.89
SD = 39.04	SD = 41.23	SD = 38.02

F = 4.37 (significant at .05)

TABLE 72

Spectographic Study: Diphthong: eɪ

(Fundamental Frequency)

E-S	A-E	M-E
180	120	180
220	220	220
220	220	260
200	240	180
220	220	160
200	180	200
200	200	200
220	200	160
240	180	220
210	200	200
200	200	240
180	200	180
220	180	180
180	200	180
160	180	180
200	200	120
200	220	200
180	220	140
M = 201.67	M = 198.89	M = 188.89
SD = 20.07	SD = 26.1	SD = 33.76

F = 1.0 (not significant)

TABLE 73

Spectographic Study: Vowel: I

$(F_2 - F_1)$

E-S	A-E	M-E
600	850	500
1210	1150	1100
760	1400	1400
1250	800	1500
900	500	1350
840	1070	1250
700	300	805
1100	1200	1100
700	1340	1380
1100	1250	1410
1110	1050	1510
850	1100	1400
600	1100	1370
1300	960	1250
950	1490	1500
1445	1300	1480
1240	950	1300
1000	1300	1570
M = 980.83	M = 1061.67	M = 1287.5
SD = 253.9	SD = 305.46	SD = 270.35

F = 5.82 (significant at .01)

TABLE 74

Spectographic Study: Vowel: I

(Duration)

E-S	A-E	M-E
150	130	140
150	130	140
110	200	100
150	200	140
70	130	100
130	220	70
100	150	100
60	140	110
100	190	120
60	230	90
70	250	80
80	200	110
70	130	130
130	200	110
90	220	130
70	180	130
100	130	110
60	220	70
M = 97.22	M = 113.89	M = 110.0
SD = 32.68	SD = 30.51	SD = 22.75

F = 1.79 (not significant)

TABLE 75

Spectographic Study: Vowel: I

(Fundamental Frequency)

E-S	A-E	M-E
200	200	200
180	180	180
200	200	200
220	180	180
220	200	160
180	180	180
200	200	180
220	140	160
220	140	220
210	160	200
200	200	200
160	180	200
180	200	180
200	200	180
160	160	180
180	200	180
180	200	180
180	200	140
M = 193.89	M = 184.44	M = 183.33
SD = 19.74	SD = 21.2	SD = 18.47

F = 1.69 (not significant)

TABLE 76

Spectographic Study: Vowel: ə

$(F_2 - F_1)$

E-S	A-E	M-E
510	550	680
1140	760	900
1050	460	800
910	980	840
950	350	600
990	1200	800
800	650	850
850	600	800
600	1100	680
900	250	740
800	1000	690
900	800	950
650	950	650
700	750	410
760	1200	700
790	1440	800
840	850	795
700	990	550
M = 824.44	M = 826.67	M = 735.28
SD = 159.12	SD = 315.3	SD = 131.24

F = 0.86 (not significant)

TABLE 77

Spectographic Study: Vowel: ə

(Duration)

E-S	A-E	M-E
140	140	150
150	80	120
100	130	100
200	110	120
80	70	150
130	110	90
70	110	120
60	100	80
80	100	170
70	120	90
70	120	90
120	120	150
80	110	120
90	110	110
90	120	180
80	90	100
70	80	120
140	80	110
M = 101.11	M = 105.56	M = 120.56
SD = 37.56	SD = 19.16	SD = 28.79

F = 2.14 (not significant)

TABLE 78

Spectographic Study: Vowel: ə

(Fundamental Frequency)

E-S	A-E	M-E
180	200	180
200	160	180
220	180	160
180	180	160
160	200	180
180	160	160
200	180	180
200	160	140
200	140	220
200	180	200
200	180	200
200	180	160
200	180	180
180	200	180
180	140	160
200	180	140
140	160	200
180	200	160
M = 188.89	M = 175.56	M = 174.44
SD = 18.44	SD = 18.86	SD = 21.48

F = 3.1 (not significant)

TABLE 79

Spectographic Study: Vowel: ɔ

$(F_2 - F_1)$

E-S	A-E	M-E
550	860	450
420	640	600
800	500	410
400	400	490
490	500	490
410	450	500
630	580	530
550	510	600
550	400	505
300	350	510
490	490	490
460	440	600
540	515	450
450	400	490
700	350	470
450	500	490
410	800	410
520	560	500
M = 506.67	M = 513.61	M = 499.17
SD = 117.57	SD = 138.77	SD = 56.16

F = 0.17 (not significant)

TABLE 80

Spectographic Study: Vowel: ɔ

(Duration)

E-S	A-E	M-E
140	100	190
150	130	150
110	140	180
140	180	190
180	100	180
130	140	180
150	140	150
160	120	100
80	140	125
110	150	190
80	150	150
130	150	150
140	130	150
90	150	150
140	160	200
120	150	150
80	170	120
110	140	180
M = 124.44	M = 141.11	M = 160.28
SD = 29.15	SD = 20.55	SD = 27.68

F = 8.57 (significant at less than .01)

TABLE 81

Spectographic Study: Vowel: ɔ

(Fundamental Frequency)

E-S	A-E	M-E
180	200	200
220	180	180
220	160	200
180	200	180
200	220	160
200	180	180
200	180	180
240	180	160
200	140	200
200	180	220
200	200	220
160	140	160
180	200	160
200	200	160
180	140	140
180	200	160
140	220	160
160	200	180
M = 191.11	M = 184.44	M = 177.78
SD = 23.98	SD = 25.26	SD = 22.64

F = 1.38 (not significant)

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