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A STUDY TO DETERMINE THE EFFECT OF WORD FREQUENCY
ON COPY DIFFICULTY FOR SHORTHAND
DICTATION MATERIAL

By

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

Shorthand dictation materials available from publishers are not equated in difficulty levels by any reliable measure. As a result of their inability to classify dictation materials by difficulty levels, shorthand instructors often violate basic learning and skill development principles and frequently use invalid and unreliable test and measurement techniques. They cannot correlate practice and test materials with the simple to complex progression of skill development or accurately measure changes in skill achievement from one test to another.

Instructors frequently experience the frustration of attempting to explain the inconsistencies of dictation materials to inquiring students. A dictation take at a given speed may seem easy or difficult in comparison to another take at the same speed, or a higher or lower speed.

Laughlin (35) provided an excellent description of the problem:

Do the skill-building materials generally used for practice progress from the easy to the difficult? Are the test materials equivalent in difficulty to the skill-building materials? The material used by teachers for supplementary skill-building or test purposes in high school classes is not now adequately equated as to difficulty level. For example, success in one test or 'take' will not necessarily mean success on the following test or 'take.' The use of poorly equated practice and test materials violates a primary principle of skill development (p. 6).

Numerous research studies and professional publications have addressed the inability of educators to standardize copy difficulty and have acknowledged the need for copy that would yield valid and reliable measures of student achievement. Adams (1, p. 8), for example, wrote: "Each test at any specified speed should be consistent in difficulty to provide a reliable measure of student ability and growth." Hess and Patrick (22, p. 248) agreed with Adams and pointed out: "Tests which are not of comparable difficulty do not portray accurately students' gains in shorthand writing speed." And Pullis and Nickerson (62) suggested:

Shorthand teachers would agree that measurement in shorthand should be so designed as to indicate a change in the student's skill and not merely represent a divergence in the difficulty of the dictation material (p. 11).

Valid and reliable measurement of changes in shorthand skill development is not possible without a means for standardizing the difficulty of dictation material. As explained by Laughlin (35), the present lack of equated dictation copy affects the the performances of both teachers and students:

Neither the student nor the teacher can readily know the degree of skill or the progress from one speed to another if the tests and other supplementary materials do not provide reliable difficulty equivalency or consistent progression. This problem influences the student's attitude toward his success in shorthand, and from the teacher's point of view, no indication of progress is provided upon which to validly evaluate the student's ability at stated intervals (p. 6).

A large portion of shorthand skill assessment is based on students' ability to record dictation at given speeds and to transcribe shorthand notes. Valid, reliable measurement of skill achievement is imperative since evaluations are used for many purposes. According to Hillestad (23, p. 1), "On the basis of such shorthand tests, job placements are

made, achievement standards are set, progress in class is determined, and honors and awards are presented." Thomason (70, p. 2) also noted the importance of accurate evaluations: "Because of the importance of such tests to teachers, students, employers, researchers, and others, valid and reliable testing instruments that are of known difficulty are necessary."

In efforts to overcome the ever-present copy difficulty problem, researchers have identified various factors which might affect the difficulty of dictation material. Among those factors, syllabic intensity has been the primary measure of copy difficulty. However, Wellman (79), Flood (15), Curtin (7), Turse (75), Uthe (76), Hillestad (23), Mellinger (45), Mickelsen (47), Pullis (56, 57), Henrie (20), and Nickerson (49) have provided research indicating that syllabic intensity is an inadequate index of copy difficulty. While discussing shorthand teaching methodologies, Pullis (59) cautioned teachers about the use of syllabic intensity as a measure of copy difficulty. He warned:

Do not assume that dictation takes of identical syllabic intensity are equated in difficulty. Changes in student performance may be reflecting changes in the difficulty of dictation materials rather than reflecting changes in student proficiency (p. 87).

Since syllabic intensity is a questionable criterion for equating shorthand copy difficulty, researchers have sought to identify more reliable methods for determining difficulty of dictation material. Vocabulary level has been mentioned repeatedly as a factor that may be related to copy difficulty. During an examination of unfounded principles of shorthand instruction, Pullis (61, p. 11) noted: "Difficulty of shorthand materials is more directly related to vocabulary frequency than to syllabic intensity."

According to Thomason (70, p. 3), "The concept of vocabulary or word frequency assumes some method for identifying the words used more often than others and a subsequent ranking by order or use." Timothy Bright developed one of the earliest lists of this type in the 16th Century. Subsequent lists have been developed by Kaedig (30), Eldridge (11), Thorndike (71, 72), and Dewey (9). The first specialized office vocabulary list was developed by Horn (25) in 1926. This list was later expanded by Peterson (26).

Silverthorn (67) completed a study in 1955 in which he identified a basic vocabulary of written business communication. The sample included 2,039 items of correspondence drawn from 15 business categories in 41 states. The word list represented over 300,000 running words, and the study reinforced earlier findings that a large percentage of all correspondence is composed of a relatively small number of words.

In 1968, an updated list was developed by Perry (52) as part of a study to identify the most frequently occurring phrases in office correspondence. He developed a 317,306 corpus of words found in 2,061 pieces of correspondence taken from a variety of businesses in all but one state. The 12,109 words were ranked in order of use, and the percent of total occurrence of various groups of words was determined. Perry found that the first 100 words represented over one-half, or 53.43 percent, of words used in business correspondence; the first 500 accounted for 71.93 percent; the first 1,000, 80.66 percent; the first 1,500 represented 85.58 percent; and more than 96 percent of the words used were within the first 5,000 words.

Mellinger (43) completed a similar study in 1970 based on a 295,271 word corpus. He also used stratified samples of correspondence drawn

from a representative sample of 5,000 businesses, schools, and non-profit organizations located across the U.S. With the exception of minor variations in rank and the inclusion of several words, Mellinger's (43) list of 12,897 words was essentially the same as the lists developed by Silverthorn (67) and Perry (52).

The concept of using vocabulary level and word frequency as an index of shorthand dictation copy difficulty has become increasingly popular among researchers. Early research findings by both Wellman (79) and Flood (15) led to their conclusions that vocabulary level or frequency of usage seemed to have an impact on copy difficulty; and Mellinger (45) suggested that a word frequency index based on frequency of occurrence might be a better indicator of copy difficulty than syllabic intensity. More recently, both Hillestad (23) and Uthe (76) concluded that vocabulary level was an important factor in determining the difficulty of shorthand dictation material.

In summary of a discussion of stenographic proficiency testing, West (81, p. 32) included the requirement of "better equalizing of difficulty of copy materials via a standard word of 1.54 syllables plus a vocabulary index." This requirement was based on West's (p. 24) contention that a stenographic test should be a "good predictor of later life behavior" and that teachers should "match the content and conditions of school testing to the content and conditions of real-life uses of typewriting and stenographic skills" (p. 25).

Relating vocabulary to copy difficulty, Adams (1, p. 8) recommended use of "meaningful contextual material utilizing the proper 'mix' of vocabulary"; and he made reference to "vocabulary written in the 'world of work.'"

Other researchers now share the belief that vocabulary level or frequency of word usage may be a factor that contributes to the difficulty of shorthand dictation material. Smith (66, p. 191) reported in the 1978 National Business Education Association Yearbook: "Vocabulary level appears to have a bearing on the difficulty of copy; however, additional work is needed to refine this factor in terms of copy difficulty."

Need for the Study

Recommendations of researchers who have investigated various factors related to copy difficulty are readily available and provide evidence of need for the study. Each researcher has added to the knowledge of copy difficulty; however, no one researcher has been able to provide a reliable method for equating copy difficulty. To date, teachers do not have dictation materials that will yield valid, reliable student performance evaluations. Thus, students' successes may vary from test to test. Researchers are also restricted by the lack of standard, reliable means for determining the difficulty of shorthand dictation material.

In a discussion of implications of research for shorthand instruction, Loftus (4) related the copy difficulty problem to student success and skill development:

Without equal difficulty of dictation tests, a student's success on any one dictation test may mean only that he [sic] can write at that rate on that particular test. Without knowledge of the difficulty of the test material, neither the student nor the teacher knows the student's degree of skill nor the likelihood of his [sic] success from one test to another (p. 17).

Smith (66), in an article on evaluation and accountability, pointed out that teachers have a responsibility to assess skill achievement accurately:

If the purpose of the dictation test is to assess the recording ability, then special considerations should be given for a valid measure of the objective. In order to assess the terminal achievement of students, the instrument should be valid and reliable (p. 191).

While proposing additional study of the relationship between word frequency and copy difficulty, Thomason (70) related the copy difficulty problem to student performance by stating:

Since the major objective of shorthand instruction is to help students develop the ability to record shorthand from dictation at a vocational level of skill, teachers must be able to evaluate the achievement of students both as they progress through the instructional process and at the end of a period of training. The accuracy with which such evaluations can be made depends to a large degree on the testing instruments used. If the test is too easy, student skill is overrated; if it is too hard, students cannot pass the tests at speeds equal to their ability (p. 5).

Shorthand teachers have always had to cope with the inequality of dictation materials. They cannot select, classify, or sequence materials with confidence because there has been no reliable way to determine the difficulty level of dictation copy. While discussing evaluation and accountability in business education, Smith (66) wrote:

Much research is needed to determine factors that have a bearing on the difficulty of copy. Merely selecting a letter with a syllabic intensity of 1.40 is not adequate for establishing comparability of copy (p. 190).

In an independent study to determine the comparability of published dictation materials containing approximately the same syllabic intensities and high-frequency words, Pullis (57) explained one of the inherent problems of dictation materials:

The inability to classify dictation material according to difficulty makes it impossible for educators to know whether measurement in shorthand has been so designed as to indicate a change in the student's skill or whether it merely represents a divergence in the difficulty of the dictation material (p. 1).

Another researcher who recognized the copy difficulty dilemma, Gallion (17) commented on teachers' need for dictation material of predictable difficulty:

Dictation materials for both practice and testing purposes should be based upon materials of comparable levels of difficulty. Using material of varying and unknown difficulty does not provide a sound basis for assessing the achievement of students (p. 44).

The apparent lack of reliable methods for determining difficulty of shorthand dictation material also encumbers needed research efforts. Thomason (70, p. 6) remarked, "The lack of valid and reliable testing instruments also hampers researchers." In a study to determine factors affecting achievement in shorthand, Haggblade (19, p. 6) explained the need to validate his own testing materials by stating: "It must be emphasized that no standardized, valid tests for measuring shorthand achievement are available."

After comparing achievements of shorthand students who had been given practice dictation of varying levels of difficulty, Boggess (4) also commented that the copy difficulty problem hinders needed research:

Since the value of the present study depended, in part, on the validity of using vocabulary level as an indicator of the difficulty of shorthand dictation material, it seems to the present researcher at this point in the study that this type of study should not have been conducted yet because of the present lack of a reliable, consistent measure of the difficulty of shorthand dictation materials (pp. 62-63).

The literature is rich with recommendations for continued research of factors which might affect the difficulty of shorthand dictation material. Others who have researched copy difficulty related problems include Wellman (79), Elsen (13), Turse (75), Flood (15), Hillestad (23), Curtin (7), Farmer (14), Mellinger (44, 45), Peterson (53), Baggett (2), Henrie (20), Meyer (46), Mickelsen (47), Henshall (21), and Uthe (76).

All of them recommended additional research. Typical of those recommendations was Smith (66) who advised:

Research is needed to determine means of identifying the validity and reliability of test instruments for assessing terminal recording and transcribing achievement. Vocabulary level appears to have a bearing on the difficulty of copy; however, additional work is needed to refine this factor in terms of copy difficulty (p. 191).

Thomason's (70) study entitled "The Effect of Word Frequency on Copy Difficulty for Shorthand Testing Materials" reported that difficulty of shorthand dictation copy can be significantly changed by increasing or decreasing the percentages of words in various frequency categories by approximately 15 percent while holding constant brief forms, brief form derivatives, syllabic intensity, number of actual words, and number of different words. Thomason's recommendations for additional research specifically included: "A study should be undertaken to determine whether a variation of less than 15 percent in the word frequency categories will produce results similar to those of the present study" (p. 88).

Purpose of the Study

The purpose of this study was to further determine the effect of word frequency on copy difficulty for shorthand dictation material and to identify criteria that could be used to develop shorthand dictation material of predictable difficulty levels. The information may contribute to development of valid and reliable dictation material, i.e., dictation material to accurately measure prescribed skill development levels and to provide stable measurements. Teachers would be able to provide more adequate and meaningful evaluations of student achievement, and they would be able to arrange dictation materials in sequential order from simple to

complex in accordance with progressing skill levels. Additionally, research findings might be more accurately compared and evaluated.

Statement of the Problem

This study was undertaken to further determine the effect of word frequency on copy difficulty for shorthand dictation material. Answers were sought to the following questions:

1. Can the difficulty level of dictation material be changed by varying word occurrence percentages for frequently used word categories of the Perry (52) word list while holding constant brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words?
2. Can shorthand dictation materials of equivalent difficulty levels be developed by controlling percentages of words listed in seven frequency categories of the Perry word list while holding constant brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words?

The dictation materials developed for this study were based on the assumption that Perry's word list provided a valid indication of the frequency of occurrence of words used in business correspondence. Six three-minute dictation tests were developed. Two average-level tests contained equivalent percentages of words from seven word frequency categories. The word occurrence percentages were increased 10 percent to determine the percentage of words that would be used in each category to develop two easy-level tests. Two hard-level tests were developed by reducing Perry's word occurrence percentages by 10 percent.

Word frequency was isolated as the independent experimental variable to the extent possible by controlling five other factors which might affect the difficulty of the dictation materials. Each test contained approximately 44.73 percent brief forms and 3.16 percent brief form derivatives, 1.5 syllabic intensity, and 240 actual words. All tests contained approximately the same number of different words.

Hypotheses

Using six three-minute dictation tests written for this study, six null hypotheses were tested to determine whether shorthand dictation materials of statistically equivalent difficulty could be constructed:

1. There is no statistically significant difference in average difficulty between two easy-level tests as measured by average transcription error scores.
2. There is no statistically significant difference in average difficulty between two average-level tests as measured by average transcription error scores.
3. There is no statistically significant difference in average difficulty between two hard-level tests as measured by average transcription error scores.

The following null hypotheses were tested to determine whether the difficulty level of shorthand dictation material could be significantly changed by varying word occurrence percentages of frequently used word categories:

1. There will be no statistically significant difference in mean transcription error scores on easy-level tests and average-level tests.

2. There will be no statistically significant difference in mean transcription error scores on average-level tests and hard-level tests.
3. There will be no statistically significant difference in mean transcription error scores on easy-level tests and hard-level tests.

Delimitations

The following delimitations are applicable to this study:

1. Gregg Shorthand, Diamond Jubilee Series, shorthand system was used for this study.
2. Subjects for this study were limited to shorthand students enrolled at Oklahoma State University during the Fall Semester, 1980.
3. All percentages used for word frequency counts were based on findings of the Perry (52) study.
4. Words used in constructing test instruments for this study were taken from word frequency categories in the Perry study.
5. Only shorthand related errors made on the subjects' transcripts were considered. The scope of this study did not include evaluation of shorthand outlines or nonshorthand errors.
6. Subjects were not identified or classified by IQ, age, sex, socio-economic, cultural, or ethnic background.
7. The test instruments were administered to subjects who wrote at least 80 but less than 100 words per minute on preliminary tests. Effects of other speed levels, if any, were not considered.

8. Transcription speed was not a selection criterion or consideration in this study. Transcription rates were not calculated. However, transcripts were completed within the class period in which the shorthand notes were recorded.

Limitations

The primary limitations of this study were as follows:

1. The effect of tape-recorded dictation presented by an unfamiliar dictator is not known. However, all subjects had previously received taped practice dictation from a variety of dictators. They also experienced the dictator's voice during four preliminary tests.
2. The effect of using random assignment of subjects to treatments is not known. Random assignment to groups and presentation orders was used to facilitate the use of predetermined statistical procedures.
3. The effect of holding constant brief forms, brief form derivatives, number of actual words, and number of different words on tests used in this study is not known. All tests were treated the same with regard to these factors, however.
4. The effect of limiting participants in this study to university-level students writing at least 80 but less than 100 words per minute is not known. The participants represented a range of second, third, and fourth semester Gregg shorthand students.
5. The effect of using pretests controlled only by syllabic intensity for selection of participants is not known. However, the same tests were used to select all of the subjects.

Definition of Terms

To assist with the interpretations of this report, the following terms are defined as they were used in this study:

Brief forms--Abbreviated outlines for certain words that are used in the Gregg system to facilitate more rapid writing.

Brief form derivatives--Words which include brief form outlines.

Common words--Words within the first 500 words of the Perry (52) word list.

Difficulty level--The comparative degree of difficulty of shorthand dictation items on the scale of easy, average, and/or hard.

Easy--A three-minute dictation item in which percentages of words identified by Perry have been adjusted to contain approximately 10 percent more words in the high-frequency groups shifted from low-frequency groups.

Average--A three-minute dictation item in which word occurrence percentages of seven word frequency categories conform to those identified by the Perry study.

Hard--A three-minute dictation item in which percentages of words identified by Perry have been adjusted to contain approximately 10 percent more words in low-frequency groups shifted from high-frequency groups.

High-frequency words--Words listed within the first 100 words on the Perry word list.

Nonshorthand transcription errors--Errors in the transcript not related to the translation of shorthand outlines into typewritten copy such as spelling, grammar, punctuation, or typographical errors.

Number of actual words--The total number of individual words found in each of the six dictation instruments developed for this study.

Number of different words--The total number of different words which were used at least once within each of the individual instruments developed for this study.

Perry word list--A list of 12,109 different words by their frequency of occurrence based on an analysis of 2,061 different business letters incorporating 317,306 word occurrences.

Shorthand transcription errors--Errors in shorthand transcripts including additions, omissions, or transpositions of words.

Standard word--a uniform index of the quantity of dictation material. Dictation materials used for this study were paced with a standard word of 1.5 syllables.

Syllabic intensity--The average number of syllables per word in a dictation item as determined by dividing the total number of syllables by the total number of actual words.

Test take or dictation take--A three-minute item of dictation composed of unfamiliar, new material.

Transcript--The typewritten translation of shorthand symbols.

Vocabulary level--The numerical rank of individual words on the Perry word list.

Assumptions

The following assumptions formed the basis for this study:

1. Perry's (52) word list is a valid indicator of the frequency of occurrence of words used in business correspondence.

2. The percentages indicated for word frequency categories in the Perry list are representative of typical business correspondence.
3. A three-minute dictation test/take is an adequate measure of shorthand skill.
4. The dictation materials used as pretests for selecting subjects were as adequate as any presently available for this purpose.

Summary

Researchers have not determined/developed a means for measuring and/or controlling copy difficulty for shorthand dictation materials. Research indicates that vocabulary level may be a factor that affects the difficulty of shorthand dictation material. This study sought to determine (1) whether dictation materials with equal percentages of words from seven word frequency categories would be of equivalent difficulty and (2) whether copy difficulty levels could be changed by varying percentages of words in word frequency categories by approximately 10 percent while holding constant brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words.

The remainder of this study is organized in the following manner: Chapter II contains a chronological review of literature related to copy difficulty research. Chapter III summarizes the procedures used to collect and treat the data for this study, and Chapter IV reports the findings obtained. Chapter V contains a summary of the study together with conclusions and recommendations.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The lack of valid, reliable shorthand dictation materials adversely affects the performances of students, teachers, and researchers. Methods for equating the difficulty of dictation materials have not been identified; however, knowledge of shorthand copy difficulty has been increased during the past fifty years as a result of researchers' attempts to investigate a myriad of hypotheses. A rudimentary body of knowledge is now available to researchers who seek to expand the scientific basis for equating difficulty levels of shorthand dictation materials.

The literature related to copy difficulty has been reviewed by several researchers during past years, and most of them have organized literature reviews by factors and variables studied. In order to promote a comprehensive review of the evolution of copy difficulty knowledge, Chapter II presents a chronological review of studies conducted to investigate factors regarded as copy difficulty determinants.

Chronological Review of Copy Difficulty Research

Schramper, 1927

A study by Schramper (65) in 1927 reported shorthand stroke count as a more reliable measure of copy difficulty than a measure based upon

words or word units. Three letters with average shorthand stroke counts of 2.32, 3.53, and 4.59 respectively were administered to first, second, third, and fourth semester high school students. The study concluded that the third letter was the most difficult letter for students to write in shorthand. Schramper reported:

The first letter, Test One, consists of very common words, many of which have probably been made automatic by the student. Test two contains words of greater difficulty and Test Three has many words that are little used and little drilled upon in the classroom (p. 123).

Schramper recognized, however, that "mental difficulty with unfamiliar words" hampered the usefulness of her method and suggested that adjustment be made for uncommon words (p. 126). The word frequency factor was not considered in the study conclusions.

Leslie, 1931

Syllabic intensity was used as a measure of copy difficulty in Gregg textbooks prior to 1930; however, it did not appear in shorthand test materials until 1931. During that year, the standard of 1.4 syllables per shorthand word was introduced by Leslie (37) following a recommendation by Gregg. The standard word was based upon 1.4 syllables for every 20 words, or 28 syllables for each 20-word group.

The 1.4 figure was derived from analyses of New York State Regents Examinations, shorthand speed contest materials, dictation test copy of the Gregg Publishing Company, Congressional Record material, and word studies available at that time. Leslie was one of the first authorities to support syllabic intensity as a measure of difficulty in shorthand dictation material. He promoted the syllabic intensity measure as an accurate guide to the average length of words as well as to the spread

of vocabulary. This premise inferred that a high syllabic intensity in dictation copy indicated a higher percentage of low-frequency words.

By contrast, Leslie (39, p. 282) later acknowledged the impact of vocabulary on copy difficulty by stating, "the difficulty of transcription varies in accordance with the spread or range of the vocabulary." Yet, he chose syllabic intensity as a measure of difficulty over a vocabulary measure because it was simple to compute and because, as he stated: ". . . empirically we know that the syllabic intensity gives us a good estimate of the difficulty of ordinary English running material because it also gives us a good estimate of the spread of the vocabulary" (p. 282). Hillestad (23) later challenged this assumption by pointing out that dispersion (vocabulary spread) cannot be shown with a measure of central tendency (syllabic intensity). As she explained, the relationship between syllabic intensity and vocabulary spread is not linear.

A few years later, Leslie (38) reported in a journal article that a number of attempts had been made to determine factors that could be used to control copy difficulty for shorthand dictation material. Some factors investigated were: typing stroke count, shorthand character count, sound count, artificial restriction of vocabulary, vocabulary spread index, vocabulary index, sentence length, syllabic intensity, and the standard word. He advocated further research to discover a means of measuring dictation material simply and easily.

Wellman, 1937

A study by Wellman (79, p. 2) in 1937 attempted to answer the question: "Can the inherent difficulty of dictation material be regulated through control of factors that can be measured objectively?" To obtain

empirical evidence, Wellman tested traditional assumptions relating to syllabic count, stroke count, length of sentences, and vocabulary frequency as determinants of stenographic difficulty. Each factor was controlled in two batteries of tests administered to 445 students in 15 schools and colleges. The mean number of transcription errors on each of ten tests were compared for significant differences.

Wellman's study results are summarized as follows:

1. Shifting 30 percent of the vocabulary from the rank of 1,000 most-frequent words into the 2,000-5,000 ranks, with other factors constant, yielded a significant difference.
2. An increase in difficulty was observed when spelling demons were incorporated.
3. No significant difference in difficulty was found when sentence length was doubled.
4. A 20 percent increase in shorthand stroke content did not yield a significant difference in difficulty.
5. The difference in difficulty was not significant when syllabic content was increased by 28 percent.
6. A combined increase of 17 percent in syllabic intensity and 20 percent in stroke intensity did not produce a significant difference in difficulty.
7. Shifting 12 percent of the vocabulary from the 1,000 most-frequent words to higher levels within the 3,000 most-frequent words did not yield a significant difference in difficulty.

Results of the Wellman study showed that it is possible to select or construct materials on the basis of differentiated variables, but the study failed to differentiate the grade of difficulty. Wellman concluded

that vocabulary level appeared to be a better measure of difficulty than syllabic intensity, number of words, number of strokes, and number of occurrences of ranked word forms. She further remarked:

Elusive qualitative elements, intrinsic to the thought and language content of the dictation materials, are more likely determinants of stenographic difficulty than are the physical components that can be measured and objectively scaled (p. 87).

Wellman acknowledged limitations in the interpretation of her findings imposed by lack of statistical and quantitative measures for analyzing the data. Uthe (76) recommended that the results of this study be generalized cautiously since the two batteries of tests were given to different groups with no randomization indicated.

Elsen, 1946

Elsen (13) studied syllabic intensity, vocabulary spread, and shorthand character count as difficulty factors of shorthand dictation material. As a result of her study in 1946, she contradicted Wellman's (79) findings and determined syllabic intensity to be a better predictor of difficulty than the factors of vocabulary spread and shorthand character count. During the study, 100 students recorded two series of six tests (400 actual words each) with syllabic intensities ranging from 1.3 to 1.9. The material was dictated at 80 words per minute. Vocabulary weights increased by .5 for each group of 500 words in order of frequency on the Horn-Peterson (26) word list.

To facilitate visual analysis of the data, syllabic intensity and number of errors on each item were plotted on line graphs. No statistical tests were applied; however, after visually inspecting the data, Elsen alleged that syllabic intensity was more closely related to total error level than either vocabulary spread or shorthand character count.

Both Hillestad (23) and Uthe (76) called attention to several problems inherent in Elsen's study. Units for syllabic intensity and units for errors were shown on separate scales but presented in the same graph. Conclusions were based on visual inspection rather than statistical analysis, and no statistical tests of significance were performed on the difference in errors made on the two sets of dictation. Uthe (76) commented:

The degree of relationship between syllabic intensity and errors was not considered by Elsen, although validity of an instrument is the degree of relationship between that instrument (the predictor, syllabic intensity) and the criterion (errors) (p. 16).

Thomason (70, p. 20), in a 1979 study, also commented on Elsen's study: "It should be noted that random selection of the letters was not indicated, and students apparently had little experience with material such as Congressional speech."

Turse, 1944-1948

In 1944 Turse (74) suggested the shorthand stroke as a means of determining difficulty. He proposed that a combination of shorthand word count, actual word count, and shorthand stroke be developed to increase the predictive power of syllabic intensity. If this could not be done, however, he recommended use of one or a combination of factors that came closest.

In 1948, Turse (75) undertook what he described as a limited study involving three measurable factors: word length, syllable count and shorthand count. The data were secured from 144 applicants for stenographic positions in an industrial organization. Screening tests of three letters (150 words each) were dictated at 60, 80, and 100 words per

minute. The context of the tests included approximately 30 percent common recurring words, a random sampling of shorthand principles (Gregg) and an occasional interspersed of words in contextual situations known to have high error frequency.

None of the resulting correlation coefficients were greater than .28. Therefore, none of the three factors were considered valid measures of difficulty. When citing uncontrolled factors affecting difficulty, Turse (75, p. 30) commented on his observation that the contextual setting of a word appeared to make a difference: "It is evident, then, that the difficulty of a given word in shorthand dictation may vary, depending upon the chance contextual position or structure in which it appears."

Flood, 1953

A study by Flood (15) in 1953 made an inspectional analysis of the initial learning materials of Gregg Shorthand Simplified and Thomas Natural Shorthand. Materials used by the two systems were analyzed to discover what provisions had been made for gradation (progression from simple to complex) of the materials and to determine some of the factors that might make the materials unnecessarily difficult. Identification of the difficult factors involved an analysis of the number of repetitions provided by the vocabulary contained in the initial learning materials. At the conclusion of the study, Flood suggested that frequency of word use may be a better indicator of copy difficulty than syllabic intensity. Moreover, she questioned the practice of using syllabic intensity as the sole determinant of copy difficulty and believed that frequently used long words might be easier to learn than unfamiliar short ones.

Wessman, 1956

Wessman (80) conducted a study in 1956 to determine the effect of varying time lapses on accuracy of shorthand transcription and noted a relationship between word frequency and difficulty as measured by errors made in shorthand notes. Two selections with the same syllabic intensity were dictated to 72 students randomly selected from four shorthand classes in three schools. The percentage of errors made on the second was consistently higher than on the first. Despite identical syllabic intensities, a statistically significant difference existed between the two letters in the distribution of words in the frequency groups. A higher error incidence occurred with the letter containing more low-frequency words. Therefore, Wessman concluded: "students do have more trouble writing less common words" (p. 42).

Curtin, 1958

In a study to determine the relationship between selected factors and difficulty of dictation materials, Curtin (7) in 1958 tested the Cloze procedure used in the language arts field as a measure of readability of both oral and written communication. Adhering to the procedure developed by Taylor (69), every fifth word was omitted in three letters, and students were instructed to fill in blanks by guessing. As the number of correct responses increased, the Cloze score increased; and a high Cloze score indicated easy material.

Curtin assumed that an inverse relationship would exist between the Cloze score and shorthand errors, if the Cloze score could predict difficulty. She dictated a sample of 41 letters randomly selected from a published dictation textbook to nine classes of second-year shorthand

students to obtain the number of shorthand errors and derived predictor scores for each letter. Using syllabic intensity and a vocabulary index developed by Hillestad (23), Curtin made correlations between shorthand error scores and the predictor scores for the Cloze procedure. The study did not confirm a relationship between Cloze scores and the number of errors made on shorthand notes. The correlation coefficient between the vocabulary level index and errors made on shorthand notes was .501. This figure was not significant; however, Curtin concluded that vocabulary level appeared to be a better predictor of difficulty than either the Cloze score or syllabic intensity.

Danielson, 1959

Danielson's (8) study in 1959 was designed to determine the relationship between shorthand vocabulary and achievement in shorthand dictation. She reported that shorthand vocabulary competency was significantly related to shorthand dictation rate achievement. As students achieved higher dictation rates from 60 to 130 words per minute, they achieved higher vocabulary index levels.

After selecting 50 words from each 1,000-word level in Silverthorn's (67) word list, Danielson developed six word-list tests of 250 words each. The tests were dictated to 120 university-level students during a two-semester period. Beginning in September, one test was given every six weeks, and students were instructed to write the dictated words in shorthand and transcribe them on the typewriter. The number of words transcribed correctly was used as the vocabulary index.

Additionally, Danielson constructed 30 sets of business letters using 1.5 syllabic intensity. One set of letters was dictated each week

at speeds ranging from 60 to 130 words per minute. Students were required to pass three takes to establish their dictation rates.

Significant differences were found among high, middle, and low shorthand vocabulary groups. Results of the study seemed significant since vocabulary competency was significantly related to shorthand dictation achievement, indicating that shorthand vocabulary competency increased as the rate of taking dictation increased. However, Uthe (76) questioned the equality of the tests since syllabic intensity had previously been shown to be an inadequate measure of difficulty; and therefore, all tests could not be considered of equal difficulty.

Crandall, 1960

Crandall (6, p. 67) assumed "that the actual frequency of words as found by Silverthorn would serve as the basis for a good index of relative difficulty of words in shorthand dictation and transcription." He undertook to determine the average frequency of words used in shorthand dictation materials as measured by the Silverthorn (67) high-frequency word count.

Crandall assumed that more frequently used words would be easier to write and transcribe through repeated practice and that less frequently used words would be harder since they had been written fewer times. Crandall used Elsen's (13) results showing syllabic intensity and transcription errors per student for six tests together with Silverthorn's list. He computed a composite word frequency index for each letter expecting a positive correlation between the frequency index and shorthand errors. The study did not achieve the anticipated results.

Surmising that the high frequency of a relatively few words distorted the relationship of word frequency and transcription errors, Crandall made a further analysis listing the number of the hundred block in which a word appeared in Silverthorn's (67) study. In conclusion, Crandall reasoned:

When one recalls that the first one-hundred block contains the words used in over 52 percent of business communication, there arises the question as to the significance of an index based on each hundred block (p. 68).

Crandall also explained that transcription errors were more directly related to communication composed of infrequently used words. He pointed out that ability to write less frequently used words was, therefore, of major importance to learners.

Hillestad, 1960

With computer assistance, Hillestad (23) researched the problem of developing a multiple regression equation to predict the number of errors students were likely to make in shorthand notes when recording a dictation test. Two types of data were gathered on especially prepared dictation material from which the regression equation was derived: (1) characteristics in words, and (2) characteristics of shorthand symbols for brief forms and their derivatives, blended sounds (nd, nt, md, mt, ted, rd, ld, tem, and ten), vowel sounds (oo's, o's, and diphthongs), terminal t's following k or s, plurals and past tenses, suffixes, and prefixes.

One hundred letters were written incorporating the above mentioned variables. Each letter contained 160 words and was revised from an actual business letter. Letters were dictated by teachers over a three-month period at speeds students could write comfortably. All letters

were randomly placed in blocks, and the blocks were randomly assigned to eight high school fourth-semester classes writing Gregg Simplified. All students took all letters (eliminating the effect of learning during the testing period), and five papers were randomly selected from each of the eight classes to provide a sample of 40 papers checked for each letter. One error per word was counted. Errors were not counted for placement on the line, size, proportion, or reversal of letters unless it changed the letter.

Hillestad found a multiple correlation coefficient of .948 for the relationship between 16 variables and error scores. She then tested each of the 16 variables for predictive ability; six variables remained significant. A second equation employing only the six significant variables had a multiple correlation coefficient of .943. Hence the six variables seemed to predict shorthand errors (difficulty) nearly as well as the equation using all 16 variables.

Further analysis of R^2 , the proportion of total variance in number of shorthand errors which may be attributed to the predictors, revealed that two variables, syllables and vocabulary level index, accounted for 73.36 percent of the total variance in error scores. The amount of criterion variance due to regression was 88.92 percent; therefore, 15.56 percent of the variance was contributed by the remaining four variables (principles of the shorthand system).

Hillestad employed a third prediction equation, using only syllables and vocabulary level index, to determine the appropriate weights to assign the two variables that contributed most to variance of errors. She then substituted the variable entitled "words beyond 1,500 on the Silverthorn list" for "vocabulary level index" and obtained a coefficient

of .78 for the relationship between the two remaining variables. She concluded that the equation with only two variables adequately predicted difficulty and was much easier to compute.

Hillestad analyzed the number and kinds of errors in students' shorthand notes and reaffirmed other findings. The variable "words beyond the first 1,500 on the Silverthorn list" contributed twice as much to variability in number of errors as did the variable "syllabic intensity." Students had lower error scores on brief forms than words constructed according to principles of the system. As words became longer, the error rate also increased.

She recommended that more attention be given to vocabulary level and the number of words beyond the first 1,500 on Silverthorn's (67) list. Results of the study indicated that the percentage of errors increased as the frequency of occurrence of words decreased. Less than 15 percent of the errors were made on the first 100 words of the Silverthorn list; five times that percentage were made in the category 101-300. It was noted that the percentage of errors increased from 3 to 6 percent with each word frequency category to a peak of 42 percent errors on words ranking beyond 5,050. Hillestad also recommended automatization of a greater number of the first 500 words on Silverthorn's list as well as more work with brief forms and brief form derivatives.

Subsequent researchers pointed out possible problems in Hillestad's research design (76) (49). No controls were applied to the speed of dictation. The letters may not have been representative of business correspondence, and only shorthand errors were considered. In selecting a random sample of five papers from each school for each of the one hundred letters, some students were included in the sample more than

once; therefore, the error scores contained an undetermined amount of dependence for each letter.

Farmer, 1961

Farmer (14) attempted to validate Hillestad's (23) prediction equation in 1961. She tested the validity of the prediction of the difficulty level of dictation materials made by the regression equation against the criterion of students' transcription scores. From the 100 letters used in Hillestad's study, Farmer selected 83 letters that had approximately the same syllabic intensity as published dictation materials. For the equation, the number of words beyond the first 1,500 on the Silverthorn (67) list and syllabic intensity were used as the best predictors. The 83 letters were stratified into high, medium, and low difficulty levels based on syllabic intensity and number of words beyond the first 1,500. Two letters were selected from each category (a total of six) and dictated at 60 words per minute to 96 students in six classes of second-year Pitman shorthand.

An analysis of variance was used to test the mean number of transcription errors among six classes and among three difficulty levels. Farmer found a significant difference in the mean transcription error scores on letters of three levels of difficulty. Letters classified as difficult were significantly more difficult than either the medium or easy classifications. The difficult, average, and easy classifications had mean transcription error scores of 73.69, 44.19, and 47.06 respectively. The difference in difficulty between medium and easy difficulty levels was not significant. Farmer concluded that the formula had not been successful in determining three levels of difficulty.

Farmer discounted the conclusions of her findings and recommended further research efforts to validate Hillestad's (23) formula. She cited two reasons for her recommendation. First, Hillestad developed the formula using Gregg Simplified, and the theory of difficulty might not be a valid predictor for other systems. Second, lack of significant difference between easy and medium letters may have been the result of the influence of one class in which the low-ability students were assigned by random choice to take easy letters and the best students were assigned to take medium-difficulty letters.

Peterson, 1964

Peterson (53) attempted to validate Hillestad's (23) formula in 1964. Eight one-minute letters were constructed with 1.4 syllabic intensity and the 1.4 standard word held constant. The letters were composed of increasing numbers of words from Silverthorn's (67) list. The progression of numbers of words from one letter to another was irregular and has been described by Uthe (76, p. 42) as "a questionable technique." Peterson used transcription scores as the criterion variable and found wide error variances within the three levels of difficulty. The coefficient of correlation for Y' and percent of error for the entire group was too low for predictive purposes.

Based on the study findings, Peterson concluded that Hillestad's formula was not entirely reliable. Uthe, however, suggested that the study be viewed cautiously because of the irregular progression of words in the letters, brevity of the letters, and lack of information about similarity of classes in which the data were collected.

Baggett, 1964

Baggett's (2) study was designed to validate Hillestad's formula. Likewise, he used transcription errors as the criterion and attempted to determine whether there were significant differences at the six levels of difficulty predicted by Hillestad (23).

Six letters were selected from those used by Hillestad and arranged in the predicted order of increasing difficulty from 1 through 6. The letters were dictated at 80 words per minute to 600 Gregg Simplified students in seven fourth-semester classes. Fifty transcripts were randomly selected for analysis. The mean transcription errors for the papers ranged from 2.31 to 8.65. There were differences in the scores; however, the differences were not in the order expected when the Spearman rank-order correlation coefficient technique was applied.

The final results ranked the six letters in an order of 2, 3, 4, 1, 6, 5, instead of the 1 through 6 order that Hillestad's formula predicted. Baggett offered possible explanations for the unexpected letter order. The effect of class size may have affected results since the sequence of difficulty found among letters was not the same for all classes. In addition, he suggested that other factors such as length of sentence, series of words, order of words, and vocabulary level be studied for effects on difficulty of shorthand dictation materials.

Mellinger, 1964

In 1964 Mellinger (45) challenged the assumption that syllabic intensity of a word indicates whether that word is easy or hard for shorthand instruction purposes. He proposed a word frequency index to

determine copy difficulty. In an attempt to determine whether the 1.4 measure is in fact reliable, Mellinger (44) analyzed Silverthorn's (67) word frequency list (300,000 running words of business correspondence appearing in 2,039 different pieces of written business communication representing 15 business categories in 41 states).

Results showed that the average syllabic intensity of all 300,000 words is 1.56 and that the average is 2.2 when the first 200 words are eliminated. In his call for a new measure of copy difficulty, Mellinger (44) stated:

It may be necessary, in the light of the findings of this study, to reconsider the widely held idea that syllabic intensity is by and large a yardstick of vocabulary difficulty, and to substitute a word-frequency criterion (p. 10).

Mellinger (44) further pointed out that students could not write low-frequency words with the same syllabic intensity as fast as those with high frequency. For example, monosyllabic words such as "in," "of," and "to" are written with high frequency and ease. However, monosyllabic words such as "axe," "prune," and "realm" are written with low frequency and greater difficulty. A word frequency measure recognizes that differences in words may affect recording difficulty/ease whereas the syllabic intensity measure assumes all monosyllabic words are equal in difficulty.

In a subsequent article, Mellinger (45) proposed that use of a word frequency index need not be complicated. Returning to knowledge gleaned from the Silverthorn study, he reiterated that the 200 most frequently used words on the list account for 60 percent of the 300,000 words. His blueprint for a word frequency index included: classifying as "average" those letters with 60 to 69 percent of their words from the first 200

words; classifying letters with less than 60 percent of their words from the first 200 words as "difficult"; and classifying letters with 70 percent or more of the first 200 words as "easy."

Concurring with Crandall (6), Hillestad (23), and others, Mellinger (45) advocated more emphasis on infrequently occurring words, words beyond 200 on the Silverthorn (67) list.

Uthe, 1966

In view of attempts by Farmer (14), Peterson (53), and Baggett (2) to validate Hillestad's (23) formula when carried through to the transcription phase, Uthe (76) attempted to develop a new formula that would consistently predict the difficulty level of dictation material used in learning and testing situations. The problem was to develop a multiple regression equation to predict the number of errors students would likely make in shorthand notes when recording dictation tests. She also sought to identify those principles of Gregg Shorthand (Diamond Jubilee Series) that caused the most recording difficulty.

Using the newly revised Gregg Diamond Jubilee Series system, a different statistical design than Hillestad, and 35 variables (16 used by Hillestad plus others mentioned by previous researchers), Uthe arrived at a multiple regression formula for predicting copy difficulty. Two types of variables were used: characteristics of dictation materials and characteristics of the shorthand system. Dictation-material characteristics investigated were as follows:

- Syllabic intensity
- Vocabulary level
- Brief forms in the 1-100 vocabulary level
- Constructed words in the 1-100 vocabulary level
- Words in the 1-100 vocabulary level

Words in the 1-500 vocabulary level
 Words in the 501-1,500 vocabulary level
 Words beyond the 1,501 vocabulary level
 One-syllable words
 Two-syllable words
 Three-syllable words
 Four- to six-syllable words
 Punctuation marks
 Sentence length
 Typing stroke intensity (Uthe, p. 116)

Characteristics related to the shorthand system included the following:

Shorthand stroke intensity in brief forms
 Shorthand stroke intensity in brief form derivatives
 Shorthand stroke intensity in constructed words
 Shorthand stroke intensity
 Brief forms
 Brief form derivatives
 Blends
oo hook
o hook
 Plurals
 Blend-past tense combinations
 Past tense (t or d only)
 All past tenses
 Disjoined endings
 Joined endings
 Disjoined beginnings
 Joined beginnings
 Diphthongs
 Word beginnings
 Word endings (Uthe, p. 116)

Twenty-five groups of fourth-semester high school students recorded at 80 words per minute four randomly assigned letters selected from the 100 letters developed by Hillestad (23). All students also recorded three common letters. The 35 mentioned variables were used in a stepwise regression computer program to identify the best predictor(s) of error scores at the .95 level of probability. Variables that remained at the .95 level were used in a correlation and multiple linear regression computer program to find the correlation coefficient of the variables to error scores, the weighted regression coefficient, and predicted error scores.

The selected predictors included brief forms, word endings, and words beyond the first 1,500 on Silverthorn's (67) list. They were combined in an equation. The correlation between the variables and word error scores was .76, and the multiple coefficient of determination was .58. By using standard deviations above and below predicted word errors, Uthe established difficulty categories of "easy," "average," and "hard."

Six letters were selected to validate the equation, and the letters were administered to all students in four classes in one school. The equation successfully predicted the rank order of the letters. As a result of the procedures used for the study, Uthe (76, p. 118) developed a method of adjusting the equation for differences in students' abilities. The scale for classifying dictation material is shown below:

<u>Number of Errors</u>	<u>Difficulty Level</u>
0 - 7.11	Extremely Easy
7.12 - 15.49	Very Easy
15.50 - 23.87	Easy
23.88 - 32.25	Average (low)
32.26 - 40.63	Average (high)
40.64 - 49.01	Difficult
49.02 - 57.39	Very Difficult
57.40 - +	Extremely Difficult

In her procedures for classifying materials, Uthe noted that the scale determined the difficulty level for students of average ability writing at 80 words per minute and suggested adjustment of one standard deviation above and below to accommodate differences in ability or speed. In conclusion of her study, Uthe stated: "The regression equation for predicting errors is valid for use in classifying dictation materials into easy, average, and difficult levels of difficulty" (p. 119).

Meyer, 1967

A major purpose of Meyer's (46) study was to validate the formula

developed by Uthe (76) for determining the difficulty of shorthand dictation materials. The procedures of the study included the selection of twelve letters from the 100 developed by Hillestad (23) and later used by Uthe in developing her formula. Four letters were classified as "easy," four as "medium" difficulty, and four as "difficult." The letters were recorded on tapes for dictation to fourth-semester high school students. Analysis of variance on the transcript errors showed no significant difference in the groups, but there were significant differences on the twelve letters and on the three levels of difficulty. Significant differences were also found within each level of difficulty.

Scheffe' test comparisons of mean transcript error scores for the twelve letters did not show a distinct division into three levels of difficulty. Meyer, therefore, concluded that her effort to validate Uthe's formula (using transcription errors scores) was inconclusive, other than being able to identify general categories of "extremely easy" and "extremely hard." However, she did identify some residual factors that might contribute to copy difficulty. These included awkward sentence wording, extremely high syllabic intensity, possible curvilinear relationship of syllabic intensity and difficulty, and subject matter of interest to students.

Meyer recommended further study to identify factors that make dictation material difficult and that further attempts use published classroom materials rather than specially written letters covering specific principles.

Bogges, 1970

An experiment was conducted during the school year 1969-70 by

Boggess (4) for the purpose of comparing the achievement of shorthand students who had been given practice dictation of varying levels of difficulty. One objective of the study was to contribute to a means of developing in shorthand students the ability to record and transcribe dictation materials at all levels of difficulty.

Four student groups were given four kinds of dictation. One group was given easy dictation; one, average; one, difficult; and one, a progression of easy to difficult. Levels of copy difficulty were established by a measure of vocabulary level (word frequency) based on Silverthorn's (67) study. Three taped pretests (one easy, one average, and one difficult) were given to 200 randomly selected high school students. Analysis of the mean pretest scores showed no significant differences at the .01 level, leading to the conclusion that shorthand skill level among the groups was equal. However, it was concluded that the pretests, even though determined by the same measure of difficulty as the experiment material, were too similar to warrant calling them easy, average, and difficult. Boggess reasoned that this was either because the measure of difficulty (word frequency) was not reliable for measuring copy difficulty or because the percentage of low-frequency words used in each category was not sufficiently discriminating.

Posttest results identified two levels of difficulty. Therefore, the mean increases of the posttests over the pretests were analyzed. No statistically significant differences at the .01 level were found among any of the groups relative to increases on the posttests from the pretests. The conclusion was reached that the difficulty level of the practice material had little impact on the ability to record and transcribe dictation of all levels of difficulty. Boggess questioned the results

of the study and remarked that the measure chosen to determine difficulty of shorthand dictation materials was not consistent, and therefore, it was not reliable.

Mickelsen, 1970

The purpose of Mickelsen's (47) research in 1970 was to study the relationship between word frequency and difficulty of shorthand dictation materials. Areas of investigation were the relationship between (1) the mean number of transcription errors in the shorthand transcript and three selected high-frequency word indices (independent variables); (2) word frequency levels based on 500-word blocks and transcription errors at those levels; and (3) length of words as measured by syllable count and transcription errors. The study sought to determine whether an index of word frequency could be used as a single determinant of difficulty of shorthand testing materials.

Three specially constructed dictation tests were administered to 117 high school students enrolled in fourth-semester classes. Students in the study sample were recording 80 words per minute. An analysis of variance (treatments x subjects) technique was used to test the raw error mean scores for significant differences, and Dunn's "c" test was employed for making multiple comparisons. The analyses indicated significant differences among the means and between every possible pair of means.

Analysis of errors by word level in the combined tests revealed an inverse relationship between vocabulary level and transcription errors. As vocabulary level decreased in frequency, the error rate increased. In addition, Mickelsen concluded that the indices of high-frequency words used in the study were highly successful in determining three distinct

difficulty levels and that familiarity of vocabulary appeared to be a significant factor in measuring difficulty of stenographic dictation materials.

Since transcription errors were directly related to vocabulary level, Mickelsen suggested that vocabulary level might be used as a single determinant in assessing the difficulty of dictation materials for transcription purposes. Considering the results of the study, he also suggested that syllabic intensity was an inadequate measure of dictation test difficulty.

Henshall, 1971

A 1971 study by Henshall (21) also dealt with the copy difficulty problem. The purpose was to determine whether one or a combination of adult readability formulas could predict difficulty when applied to shorthand dictation materials. The research question was whether existing readability formulas could be used in combination to produce a method of prediction more accurate or more easily applied than the Uthe (76) shorthand formula.

Seventy-one transcripts using Gregg Shorthand (Diamond Jubilee Series) provided data for the study. Henshall used Uthe's formula and selected 15 of Hillestad's (23) 100 letters (covering the five difficulty levels identified by Uthe). The letters were taped at 80 words per minute and administered as five tests. Subjects for the study were enrolled in twelve college sections of beginning, intermediate, and advanced shorthand. Simple, multiple, and partial coefficients of correlation were computed to determine the validity of the formulas.

No one readability measure produced a simple correlation coefficient equal or superior to Uthe's (76) measure. However, all combinations of the formulas were significantly predictive; and a combination of the Gunning-Fog and Farr-Jenkins-Patterson formulas produced an r of .81 compared to an r of .94 for Uthe's predictive formula. Uthe's formula was recognized as a better predictor when considering order of difficulty rather than specific error scores.

Henshall measured the practicability of the formula (ease of scoring) by asking 40 prospective shorthand teachers and members of an undergraduate professional organization to apply the five formulas to each of three test letters. Comparison of the time required was used as the basis for determining ease of application, and an analysis of variance was used to determine significance of variances. Henshall concluded that readability formulas produced significantly superior results in terms of accuracy and that the time required was less for the readability formulas in each case.

Henrie, 1971

By 1971, several researchers had advocated determinants of copy difficulty and had developed a variety of formulas for predicting the difficulty of dictation materials. However, efforts to validate the formulas were not generally successful. The primary purpose of Henrie's (20) study was to analyze and compare four different shorthand difficulty level prediction formulas to determine which one was most valid.

The shorthand difficulty level prediction formulas devised by Hillestad (23), Mellinger (45), Uthe (76), and the syllabic intensity prediction formula used by Zoubek (83) were compared against the mean

word-error score, against each other prediction formula, and against each prediction formula itself. Comparisons were made by using statistical treatment formulas such as analysis of variance for repeated measures and for comparisons between means, the Pearson product-moment correlation for raw scores, the split-half reliability formula, and a t-test for testing the significance of correlation coefficients.

Results indicated that the four formulas did not agree in predictions of the difficulty of letters used. A comparison of prediction formulas against the criterion mean word-error score revealed that Hillestad's (23) prediction formula obtained the most significant correlation at the .01 level and that Uthe's (76) prediction formula was next high with a non-significant correlation. Tests for reliability disclosed that the Hillestad, Mellinger (45), and Uthe prediction formulas were significant at the .01 level. The Hillestad prediction formula showed the greatest relationship (though not significant until reaching the .15 level) when the prediction formulas were compared with the sequence of letters as listed by the syllabic prediction formula.

According to the statistical evidence resulting from this study, Hillestad's shorthand difficulty prediction formula was considered the most valid and the most reliable of the four prediction formulas investigated. The evidence further indicated that the syllabic intensity and the Mellinger prediction formulas were the easiest prediction formulas to calculate.

In the recommendations, Henrie noted that more research was needed in the area of word frequency levels because of the vast difference between the prediction formula using the most frequently used words and the prediction formula using the words beyond the first 1,500 words.

Wedell, 1972

Based on increasing evidence that word frequency might be a more accurate determinant of copy difficulty than other factors, Wedell (78) conducted a study in 1972 to determine the relationship of syllabic intensity, word frequency, and shorthand stroke intensity to the difficulty of shorthand dictation materials.

Two business letters served as dictation tests. The letters contained 240 standard words each and a similar vocabulary. The controlled factors were: syllabic intensity, 1.5 to 1.55; word frequency, same percentages of words for groupings found in the Perry (52) study; and shorthand stroke intensity. Vocabulary and syllabic intensity were controlled at the same level in each letter, and word frequency and shorthand stroke intensity were varied.

The sample included 206 post-secondary students in Gregg Diamond Jubilee Series shorthand classes. Participants could record dictation at speeds ranging between 80 and 100 words per minute. The minimum rate was 80 words per minute while no one could write above 100 words per minute with 95 percent transcription accuracy. Total errors were recorded on computer cards. The errors included the total on each of the two test letters and scores calculated as a mean error per word throughout the 17 variables (five syllabic variables, five word frequency variables, and seven shorthand stroke variables) were recorded on computer data cards.

Analysis of the mean errors per word was made within each of the three sets of variables using an analysis of variance program. The mean errors per word showed that the number of errors generally increased as the number of syllables per word increased, and the errors per word increased as the usage of the word decreased. Wedell also reported

positive correlations ranging from .44 to .68 for factors of syllabic intensity, word frequency, and shorthand stroke intensity. A Setwise Multiple Regression revealed that the highest correlation in errors between letters existed in variables of shorthand strokes.

Shorthand stroke intensity was identified as a factor in determining difficulty of shorthand dictation materials. In addition, Wedell concluded that neither syllabic intensity nor word frequency should be used as single measures in determining shorthand dictation material difficulty. He did note, however, that as the frequency of word usage decreased, the mean error per word increased.

Wedell recommended that consideration should be given to including a table for each dictation test indicating the percentage of words in each syllable classification, each word frequency group, and each shorthand stroke classification. He further recommended that computation should be made within each minute of dictation to insure uniformity throughout the dictation material.

Pullis, 1974-75

Pullis' (56, 57) interest in copy difficulty research was evidenced by his completion of two independent studies dealing with shorthand dictation material difficulty. In the first study he sought to determine whether the controlled combination of high-frequency words, average word length, and syllabic intensity could be used to accurately measure shorthand dictation material difficulty when transcription errors were used as the criterion measure.

Methods of the study included selection of three five-minute tests of exactly 700 syllables. The tests were selected from among 60 tests

included in three published speed dictation textbooks. Further, the tests were selected on the basis of divergence within three established control categories (syllabic intensity, average word length as measured by typewriting strokes, and the percentage of high-frequency words as measured by the number of words occurring within the most frequently used 1,500 words). Syllabic intensity of the three letters was 1.31, 1.43, and 1.54; average word length was 5.01, 5.37, and 5.80; and the high-frequency word index was 91.47, 86.65, and 83.51 percent.

The tests were administered at a rate of 100 standard words per minute to 32 college-level transcription students during three consecutive days. The Latin Square design for ordering was used, and students were randomly placed in three classrooms (one-third received Test I, II, or III on either the first, second, or third day). The difficulty of the tests was measured by the number of shorthand transcription errors committed. Paired t-tests were used to test for differences between each combination of the three sets of takes.

If the tests had been categorized into relative ranks by the triple control used to describe typewriting difficulty, Pullis (57) would have ranked Test I as easy, Test II as average, and Test III as difficult. Based on the actual error scores, however, Test I was difficult, Test II was easy, and Test III was average. With the t-test for paired differences, there was a statistically significant difference at the .01 level between Tests I and II, with Test II being significantly easier.

Pullis (57) concluded that the combination of variables frequently used in classifying typewriting materials into relative levels of difficulty does not accurately measure the difficulty of shorthand dictation materials. Moreover, he identified significant and appreciable

differences in difficulty levels among takes marked at the same rate within published speed dictation textbooks.

A similar research design was used for the second independent study. Pullis (56) sought to determine if published dictation materials containing approximately the same syllabic intensities and high-frequency words were of comparable difficulty when shorthand transcription errors were the criterion difficulty measure.

Three five-minute tests of exactly 700 syllables were selected from one published speed dictation textbook. The tests were selected on the basis of similarities on the two control categories of syllabic intensity and percentage of high-frequency words from the first 1,500 words in Perry's (52) business vocabulary. Test I had a syllabic intensity of 1.5 and a high-frequency word index of 85 percent; Test II had a 1.51 syllabic intensity and an 80 percent high-frequency word index; and Test III had a 1.52 syllabic intensity and a high-frequency word index of 82 percent. The Latin Square design for analysis of variance was used to order the arrangement of the tests.

Considering the equality of the test in terms of syllabic intensity and percentage of high-frequency words, Pullis (56) assumed that students' performances would be comparable. However, Test I had a mean number of shorthand transcription errors of 15; Test II, 32; and Test III, 41. With paired t-tests, statistically significant differences at the .01 level were found between Test I and Test II and between Test I and Test III.

In summary of the two studies, Pullis (56, 57) cautioned that takes composed of typical dictation and controlled on the basis of syllabic

intensity and percent of high-frequency words are not necessarily of comparable difficulty.

Nickerson, 1977

Nickerson (49) also attempted to measure the difficulty of published dictation materials. One purpose of this study was to determine whether a relationship exists between frequency of occurrence of words as measured by a business vocabulary index and difficulty of published shorthand dictation materials. She also wanted to learn the extent to which contemporary business vocabulary was used in selected five-minute dictation materials published by Gregg and whether a significant difference in difficulty would be evident in those takes when measured by number of transcription errors.

To establish proposed levels of difficulty of shorthand dictation materials, Nickerson developed a business vocabulary index based on Perry's (52) list of 5,000 most frequently occurring words in business correspondence. She assumed that frequently encountered words are automatized through frequent use and are the easiest for shorthand writers to transcribe. Eighteen five-minute takes were administered to 41 college students over a nine-week period. Transcription error scores from 738 takes were tested for variability, and a mixed model analysis of variance was used to determine the influence of three factors (difficulty, cycle, and students) on the variability among transcription errors.

Nickerson weighted each word from Perry's list by its corresponding frequency and arrived at an index of 183.37 for the list. The vocabulary index, as devised and tested, failed to identify three distinctly

different levels of difficulty in published materials; however, the hard level did differ significantly from both the average and the easy levels. Nickerson concluded that published dictation materials are not of comparable difficulty, and she remarked:

. . . it is reasonable to conclude that some device or methodology should be developed which will provide a more reliable basis for assessing relative difficulty than the syllabic intensity measure. It is apparent that students' performance on a given take is to a large extent a measure of the degree of difficulty of the particular take (p. 93).

Nickerson (49) also commented that 35 percent of the 60 dictation takes contained vocabulary distributions which did vary significantly from the distributions of words common to business communication. She, therefore, recommended further research to find means for determining difficulty levels for shorthand dictation copy and suggested additional research with published materials and variables such as syllabic intensity and the percentages of words within word frequency groups. As a caution to teachers, Nickerson concluded: "the dictation achievement attained by their students is to a large extent a selective determination of the copy difficulty of the published dictation materials" (p. 94).

Thomason, 1979

The study by Thomason (70) in 1979 skillfully incorporated much of the copy difficulty knowledge gained through previous research and was undertaken to determine the effect of word frequency on copy difficulty for shorthand testing materials. To achieve this goal, two three-minute dictation tests with equivalent percentages of words from seven word groups in the Perry (52) list were written at each of three different levels of difficulty (easy, average, and hard). The average-level tests were developed using the percentages of word occurrence found by Perry.

The two easy-level tests had approximately 15 percent more high-frequency words; the two hard-level tests had approximately 15 percent fewer high-frequency words. Each of the easy and hard tests were developed with corresponding increases and decreases in the percentages of low-frequency words.

The intricately constructed letters were also controlled for other factors identified as possible determinants of copy difficulty. The factors included: percentages of brief forms (44.73 percent per test), brief form derivatives (3.16 percent per test), a constant 1.5 syllabic intensity, the number of different words (range of 148 to 155), and the number of actual words (constant 240 words for all tests). Each one-minute segment of dictation was controlled as well as each three-minute test. The tests were tape recorded at 80 words per minute and administered in randomized order to 106 post-secondary Gregg Shorthand (Diamond Jubilee Series) students in eight classes.

To determine whether the two tests at each of the three difficulty levels were equivalent, a two-way analysis of variance was performed for each of the eight classes using raw mean transcription error scores. Twenty-three of the twenty-four tests had significant F values at the .01 level. Statistical analyses inferred that the two tests at each level were equal in difficulty. Following the completion of additional statistical procedures (weighted least squares analysis and Z score calculations), Thomason concluded that the differences in difficulty of the three levels of tests were significant.

This study made an important contribution to the knowledge of copy difficulty. Based on the data obtained, Thomason was able to draw two major conclusions:

1. It is possible to develop shorthand dictation tests of comparable difficulty by using similar percentages of words from specified frequency categories in the Perry list while holding brief forms, brief form derivatives, syllabic intensity, number of actual words, and number of different words constant (p. 86).
2. The difficulty of copy used for shorthand dictation tests can be significantly changed by increasing or decreasing the percentages of words in the various frequency categories by approximately 15 percent while holding brief forms, brief form derivatives, syllabic intensity, number of actual words, and number of different words constant (p. 87).

As a result of her findings, Thomason recommended that a study be conducted to determine whether a variation of less than 15 percent in the Perry (52) word frequency categories would produce results similar to those of her study.

Summary

Progress in the development of means for predicting difficulty levels of shorthand dictation material has advanced slowly even though researchers have identified and investigated numerous factors related to copy difficulty during the past fifty years.

In attempts to identify criteria and develop valid and reliable means for measuring difficulty of dictation material, researchers took several approaches. Some studies investigated only one factor while others dealt with a combination of factors. Characteristics of shorthand systems (Gregg Simplified, Gregg Diamond Jubilee Series, Pitman, and Thomas Natural) were examined along with characteristics of dictation materials. Researchers analyzed shorthand notes, typewritten transcripts, and combinations of both. Some researchers constructed test instruments using exacting formulas; others used published materials. Subject were tested at varying recording skill levels from 50 to 130

words per minute. The development of two major regression formulas provoked additional copy difficulty research; however, subsequent efforts to validate the formulas generally were unsuccessful.

The long-accepted 1.4 syllabic intensity measure of copy difficulty has become a debatable issue among some researchers. Most research indicated that syllabic intensity, as a single factor, is an inadequate measure of copy difficulty and that the 1.4 standard word figure is too low for contemporary correspondence. Other factors that produced unsuccessful results include the effect of sentence length, shorthand character count, shorthand word count, actual word count, average word length, the Cloze formula, readability formulas, punctuation marks, typing stroke intensity, and various components of shorthand systems. The shorthand stroke factor produced mixed results.

The terms vocabulary level and word frequency index are repeatedly mentioned in shorthand literature, and some researchers now believe that vocabulary may be a determinant of copy difficulty. Using word frequency factors, a number of studies investigated approaches to the problem and provided results which substantiated the belief that additional research is needed to confirm the effects of word frequency on copy difficulty. According to some researchers, high-frequency words are more predictive of difficulty levels; others proposed that words beyond certain word groups, low-frequency words, are better predictors. Recent evidence tends to support the premise that low-frequency words have the greatest impact on copy difficulty.

To date, researchers have not resolved the problem of identifying means for determining difficulty levels of shorthand dictation materials.

The lack of valid, reliable dictation materials continues to affect the performances of students, teachers, and researchers.

CHAPTER III

PROCEDURES FOR COLLECTING AND TREATING DATA

Introduction

The problem of this study was to further identify criteria that could be used to develop shorthand dictation materials of predictable difficulty levels. Six hypotheses were tested to answer two major research questions. First, could difficulty levels be significantly changed by increasing or decreasing percentages of words in seven categories of the Perry (52) list; and second, could comparable dictation tests be written at given difficulty levels by using similar percentages of words from seven word frequency categories while holding constant the percentage of brief forms and brief form derivatives, syllabic intensity, number of actual words, and number of different words. An account of the procedures applied to collect and treat the data used to test the hypotheses is presented in the following sections:

1. Development of Test Instruments
2. Selection of Subjects
3. Administration of Test Instruments
4. Evaluation of Results
5. Analysis of Data

Development of Test Instruments

Word Frequency Percentages

To test hypotheses associated with the first research question, dictation takes were developed using three difficulty levels--easy, average, and hard. Based on the assumption that the percentages of total word occurrence in the Perry (52) list are representative of typical business correspondence, the percentages indicated by Perry's study were used to construct average-level takes. The percentages of occurrence for seven word frequency categories in the Perry list were then increased 10 percent to establish percentages for easy-level takes and decreased 10 percent to establish percentages for construction of hard-level takes. As a result of increasing the percentages, 10 percent more high-frequency and common words were used in easy-level takes than in average-level takes; hard-level takes contained 10 percent fewer high-frequency and common words.

The 10 percent variance figure was arbitrarily determined. In a study of the effect of word frequency on copy difficulty, Thomason (70) concluded that it is possible to develop tests of comparable difficulty by using similar percentages of words from specified frequency categories in the Perry list and that difficulty of tests can be significantly changed by increasing or decreasing percentages of words in various frequency categories by approximately 15 percent. Those findings made a significant contribution to the knowledge of copy difficulty of shorthand dictation materials by showing that varying the vocabulary proportions 15 percent makes a difference. However, Thomason's study also defined a need for additional research to determine whether variations of less than

15 percent in word frequency categories could affect copy difficulty. The choice of a 10 percent variance from Perry's word occurrence percentages seemed logical because it allowed all words in easy-level tests to be within the first 2,500 occurring words.

In order to test hypotheses associated with the second research question, two dictation tests with similar percentages of words were developed at each of three difficulty levels (easy, average, and hard). The six tests were written explicitly for this study and maintained content validity by dealing with business subjects and/or issues.

Words in the Perry (52) list were separated into seven major categories with words from 1-100 in Category 1, words from 101-500 in Category 2, words from 501-1,000 in Category 3, words from 1,001-1,500 in Category 4, words from 1,501-2,500 in Category 5, words from 2,501-5,000 in Category 6, and words over 5,000 in Category 7.

Perry's corresponding percentage of total word occurrence was listed beside each of the seven categories. Those percentages were used as criteria for construction of two tests of average difficulty.

When converting Perry's percentages of total word occurrence (criteria for constructing average-level tests) to percentages to be used for constructing easy- and hard-level tests, precaution was taken to insure that changes in percentages would be proportionately distributed throughout all word categories. Computations were based on the percentage of increase from one word group to another. First, the percent of increase from one word group to another was calculated. For example, Perry indicated that the percent of total occurrence for word group 100 was 53.43 and 71.93 for word group 500. The percent of increase between the two groups is 18.5. Second, 10 percent of each percent of increase

amount was computed ($18.5 \times .10 = 1.85$), and those amounts were either added to or subtracted from the percent of increase from one word group to another ($18.5 + 1.85 = 20.35$ for easy takes and $18.5 - 1.85 = 16.65$ for hard takes) to arrive at the percentage of increase for easy-level tests and the percentage of decrease for hard-level tests.

The seven word categories and corresponding percentages for easy, average, and hard difficulty levels are presented in Table I. As a result of increasing the average percentages by 10 percent, a natural breaking point for easy-level tests occurred at the end of Category 5 since 100 percent of the words fell within the 1-2,500 word frequency group. Decreasing the first six average categories by 10 percent for hard-level tests resulted in an 86.7 cumulative percentage for the word frequency group 1-5,000. Therefore, 13.3 percent of the words in hard-level tests were from beyond the 5,000 occurring words as listed by Perry (52).

The independent experimental variable, word frequency, was isolated to the extent possible by holding constant five other factors that might affect the difficulty of dictation materials. Factors held constant were: brief forms, brief form derivatives, syllabic intensity, number of actual words per test, and number of different words per test.

Brief Forms and Brief Form Derivatives

Brief forms and brief form derivatives were held constant for all six tests since previous research by Hillestad (23), Pullis (56), Uthe (76), and Patrick (51) indicated that tests with high concentrations of brief forms are easier than average. Reese and Smith (63) further indicated that brief forms and brief form derivatives comprise 44.73 percent

TABLE I

PERCENT OF INCREASE FOR WORDS IN EACH
DIFFICULTY LEVEL

Category	Word Group	Easy		Average		Hard	
		Cumulative Percent	% of Increase	Cumulative Percent	% of Increase	Cumulative Percent	% of Increase
1	1-100	58.773	58.77	53.43	53.43	48.087	48.087
2	101-500	79.123	20.35	71.93	18.5	64.737	16.65
3	501-1,000	88.726	9.603	80.66	8.73	72.594	7.857
4	1,001-1,500	94.138	5.412	85.58	4.92	77.022	4.428
5	1,501-2,500	100.089	5.951	90.99	5.41	81.891	4.869
6	2,501-5,000			96.35	5.36	86.715	4.824
7	Over 5,000			100.00	3.65	100.00	13.285
			<u>100.089</u>		<u>100.00</u>		<u>100.00</u>

Note: Some totals may slightly exceed 100 percent because of rounding.

and 3.16 percent respectively of average business correspondence. Those percentages were used to compute the number of brief forms and derivatives allowed within each one-minute segment of the tests, and they were held constant throughout all three minutes of each test. The percentage of brief forms and brief form derivatives were not varied with the difficulty levels.

Table II contains the results of computations to determine the number of words and range allowed for brief forms and brief form derivatives in one- and three-minute segments of the six study tests. Each one-minute segment was comprised of 80 actual words, and each three-minute test contained a total of 240 actual words.

TABLE II
NUMBER OF WORDS AND RANGE ALLOWED FOR BRIEF FORMS
AND BRIEF FORM DERIVATIVES IN ONE- AND THREE-
MINUTE SEGMENTS OF THE SIX STUDY TESTS

Total Words	Brief Forms		Brief Form Derivatives	
	Number of Words	Range	Number of Words	Range
80 words	35.78	34-38	2.53	2-3
240 words	107.35	102-113	7.58	7-8

Syllabic Intensity

A number of studies found syllabic intensity to be an inadequate measure of copy difficulty. However, syllabic intensity is still indicated on some dictation material, and it is frequently mentioned in shorthand literature. For these reasons, syllabic intensity was included among the controlled factors that might affect copy difficulty.

Syllabic intensity of dictation material is a debatable issue among some business educators, and suggestions range from the traditional 1.4 to 1.65 as recommended by Perry (52). Thomason (70, p. 57) explained, ". . . it is generally agreed that 1.4 is too low; and many teachers feel that copy with a syllabic intensity of 1.65 is too difficult." Thomason also felt a jump from the familiar 1.4 to a higher syllabic intensity of 1.6 or more might affect students' performances on her tests.

A distinction should be made between syllabic intensity and standard word as the terms are used in this study. Syllabic intensity, a description of dictation material, is the total syllables in a passage divided by the number of actual words; and standard word may be defined as an artificial device used to pace dictation.

As recommended by Wedell (78), West (81), Mellinger (45), and Thomason (70), a compromise of 1.5 syllabic intensity was selected for tests developed for this study. All six test instruments were written with a precise 1.5 syllabic intensity, and each test contained 240 actual words. Each one-minute segment contained 120 syllables (80 words x 1.5); each three-minute test had 360 syllables (240 words x 1.5). Furthermore, the dictation was paced by a 1.5 standard word. Hence, the study tests were longer (contained more syllables) than regular three-minute takes at 80 words per minute. Regular 80 words per-minute takes have 336

syllables (240 words x 1.4) rather than the 360 syllables of dictation material paced with 1.5 as the standard word. Therefore, the actual dictation rate for the study tests was approximately 85 words per minute in terms of a 1.4 standard word. The decision to use 1.5 syllables to represent a standard shorthand word facilitated comparison of findings of this study with findings of Thomason's study.

Number of Actual Words and Different Words

The number of actual words and the number of different words were also controlled during the development of the six study tests. These factors have been alluded to in shorthand literature as variables which may have an impact on copy difficulty because of the potential effect on the number of errors possible in each take. Dictation copy with many different words or a greater number of total words may generate more errors than copy with a constant number of different words and actual words. Therefore, each one-minute segment of the six tests consisted of 80 actual words, and each three-minute test had a constant 240 actual words.

In order to determine the number of different words in each test, the copy was keypunched on computer cards with one word per card. The words from each test were alphabetically sorted by word on the sorter, and a manual count was made of all different words within each test. The six tests contained approximately the same number of different words. A predetermined 5 percent variance range was accepted, however. The allowable variance in total number of different words among all six tests was twelve words. Table III shows that both easy-level tests and both hard-

level tests had the same number of different words while average-level tests had a variance of five different words.

TABLE III
NUMBER OF DIFFERENT WORDS FOR EACH OF SIX STUDY TESTS

Difficulty Level	Number of Different Words
Easy, Version One	143
Easy, Version Two	143
Average, Version One	149
Average, Version Two	144
Hard, Version One	155
Hard, Verson Two	155

Internal Consistency of the Tests

Effort was made to maintain internal consistency of the tests by having each one-minute segment of each three-minute test comparable to both of the other two minutes in terms of percentages of words in each frequency category and other controlled factors. Specifically, all controls for word frequency percentages, brief forms, brief form derivatives, syllabic intensity and number of actual words were employed during development of each one-minute test segment as well as the complete

three-minute dictation test. All six three-minute tests contained approximately the same number of different words.

In conformity with the Perry study and the Thomason study, digital numbers and proper names were not used in tests. Guidelines for counting hyphenated and compound words were also followed. Salutations and complimentary closes were included in the word counts.

A form (Appendix A) was used to record and tabulate (1) the number of words required and/or used in each word frequency category, (2) the number of brief forms and brief form derivatives, and (3) the number of actual words used. A color coding system was utilized to identify different word frequency categories and brief forms and their derivatives.

Words Allowed in Each Word Group

As a result of fractional percentages of words computed for the word groups, it was necessary to have some flexibility in the number of words used for word frequency categories. A predetermined 5 percent plus or minus variance range was accepted; computations for the ranges were based on the actual number of words for a given category. Use of the variance ranges was avoided to the extent possible. The researcher ultimately stratified the tests with precise numbers of words. Tables IV, V, and VI contain the figures for the number of words allowed in each of the two tests at the easy, average, and hard difficulty levels.

Accuracy of the Tests

After each one-minute segment (80 actual words) of a test was written, the color coding system was used to first identify brief forms and brief form derivatives and then to identify the frequency category of

TABLE IV
 NUMBER OF WORDS ALLOWED IN EACH WORD GROUP
 FOR EASY DIFFICULTY LEVEL TESTS

Category	Word Group	One Minute		Three Minutes	
		80 Words	5% + Range	240 Words	5% + Range
1	1-100	47.02	44.67-49.37	141.06	134.0 -148.11
2	101-500	16.28	15.47-17.09	48.84	46.4 - 51.28
3	501-1,000	7.7	7.32- 8.09	23.05	21.89- 24.2
4	1,001-1,500	4.33	4.11- 4.55	12.99	12.34- 13.64
5	1,501-2,500	4.76	4.52- 4.99	14.07	13.37- 14.77
6	2,501-5,000				
7	Over 5,000				
		<u>80.09</u>		<u>240.01</u>	

Note: Totals vary slightly from 80 and 240 because of rounding.

TABLE V
 NUMBER OF WORDS ALLOWED IN EACH WORD GROUP
 FOR AVERAGE DIFFICULTY LEVEL TESTS

Category	Word Group	One Minute		Three Minutes	
		80 Words	5% + Range	240 Words	5% + Range
1	1-100	42.74	40.61-44.88	128.23	121.82-134.64
2	101-500	14.8	14.06-15.54	44.44	42.18- 46.62
3	501-1,000	6.98	6.63- 7.33	20.95	19.9 - 22.0
4	1,001-1,500	3.94	3.74- 4.14	11.81	11.22- 12.4
5	1,501-2,500	4.33	4.11- 4.55	12.98	12.34- 13.63
6	2,501-5,000	4.28	4.07- 4.49	12.86	12.22- 13.5
7	Over 5,000	<u>2.92</u>	2.77- 3.07	<u>8.76</u>	8.32- 9.2
		<u>79.99</u>		<u>239.99</u>	

Note: Totals vary slightly from 80 and 240 because of rounding.

TABLE VI
 NUMBER OF WORDS ALLOWED IN EACH WORD GROUP
 FOR HARD DIFFICULTY LEVEL TESTS

Category	Word Group	One Minute		Three Minutes	
		80 Words	5% \pm Range	240 Words	5% \pm Range
1	1-100	38.47	36.55-40.40	115.41	109.64-121.18
2	101-500	13.32	12.65-13.99	39.96	37.96- 41.96
3	501-1,000	6.29	5.97- 6.6	18.86	17.91- 19.8
4	1,001-1,500	3.54	3.37- 3.72	10.63	10.10- 11.16
5	1,501-2,500	3.9	3.7 - 4.09	11.26	10.69- 11.82
6	2,501-5,000	3.86	3.67- 4.05	11.58	11.0 - 12.16
7	Over 5,000	<u>10.63</u>	10.10-11.16	<u>31.88</u>	30.29- 33.48
		<u>80.01</u>		<u>239.58</u>	

Note: Totals vary slightly from 80 and 240 because of rounding.

each word used. Every word was categorized, and adjustments were made as necessary to obtain the desired word frequency percentages. As each three-minute test was completed, a comprehensive tally was made of the three one-minute segments and the accuracy verified. Then syllables were counted, syllabic intensity was calculated, and the content was revised to achieve the constant 1.5 syllabic intensity objective.

An objective editor inclusively reviewed the six tests and confirmed their accuracy. (Appendix B contains completed dictation tests. Appendix C shows a composition analysis for each of the six tests.)

Tests Were Tape Recorded

In order to facilitate simultaneous administration of the instruments and to control for dictation variance, the six tests were paced at the same rate and tape recorded by the same voice. All six tests were marked for quarter-minute dictation (30 syllables each 15 seconds, 120 syllables each minute) with 80 actual words per minute. A professional narrator recorded the tests in the sound studio at the Oklahoma State University Audio-Visual Center. The dictator was assisted by professional personnel using recording studio equipment.

The format for the preliminary test tapes and the study test tapes was similar. All tapes included specific participant instructions and warmup dictation material. The first preliminary tape presented two three-minute dictation tests at 80 words per minute; the second tape presented two tests at 100 words per minute. Each study test tape presented one three-minute test at 80 words per minute.

Selection of Subjects

The population for the study included shorthand students enrolled in second, third, and fourth semester Gregg Shorthand (Diamond Jubilee Series) classes at Oklahoma State University during Fall Semester, 1980. The sample was selected by identifying students capable of recording at least 80 but less than 100 words per minute for three minutes.

A two-day preliminary test was used to select individual subjects and to verify their recording speeds. All students received two preliminary tests at 80 words per minute and two preliminary tests at 100 words per minute. Since validated tests were not available for pretesting purposes, two tests at each speed were taken from a current tests and awards booklet published by Gregg McGraw-Hill. The syllabic intensity and syllables per standard shorthand word of the published tests were revised to 1.5 (syllables were added to each quarter-minute segment) so that the selection instruments were paced at the same rate as the study instruments and had the same syllabic intensity.

The four preliminary tests were professionally recorded on cassette tapes at the Oklahoma State University Audio-Visual Center. Two master tapes were prepared. One tape contained two tests at 80 words per minute, and the other tape contained two takes at 100 words per minute. Each tape included student instructions, warmup dictation, and two preliminary tests. To control for variance in dictation and/or dictating style, both the study tapes and the preliminary test tapes were recorded by the same professional narrator.

During the Fall Semester, 1980, the instructors administered the preliminary tests to all students in two second-semester classes, two third-semester classes, and one fourth-semester class. Fourth-semester

students were tested early in the semester before their skill advanced beyond the desired level; third-semester students received the tests toward the middle of the semester; and second-semester students were tested during the latter part of the semester as their skill approached the desired level. Since the instructors were knowledgeable about each student's recording skill, it was possible to administer the preliminary tests when the desired results could be obtained. As a result, some of the students were tested in groups, and some received the tests individually.

Transcripts of the preliminary tests were hand scored by the researcher following criteria outlined in the guidelines for administration of the test instruments (Appendix D). A list of all students in the population was prepared in advance, and students' error scores were recorded as they took each test. To receive a qualifying score, students were required to have 12 or fewer errors on the 80 words per minute tests and 15 or fewer errors on the 100 words per minute tests (95 percent accuracy). Only those students who took all four preliminary tests and who passed at least one of the 80 tests but neither of the two 100 tests were included in the sample. The 121 students in the population took the four preliminary tests, and 96 students qualified to participate in the study.

Administration of Test Instruments

Written guidelines for administration of the study tests were prepared (Appendix D). Both the researcher and the assisting instructor followed the guidelines throughout the data-collection period.

Both the students and the instructors had an opportunity to become acquainted with testing procedures during the preliminary tests. The procedures and the format of the preliminary tests closely followed that of the test instruments. The introductory material on the test tapes (See Appendix E for complete transcript) encouraged students to write and transcribe every word possible and to continue writing even though they felt their paper would not receive a passing score. Instructions were given regarding the format to be followed in preparing transcripts; and students were instructed to provide identification information including name, school name, current date, and code number used to identify particular tests. Students were not told that they were taking qualifying tests or that they were participating in an experiment. Students were told that all tests passed would be recorded for grading purposes.

During the first day of preliminary testing, students listened to introductory instructions, a one-minute warmup at 100 words per minute, and two three-minute tests at 80 words per minute. A pause was provided between the two tests. Students were given the remainder of the class period to prepare the two transcripts. The transcription period was not timed in order to promote maximum transcription effort. Students were encouraged to transcribe every word they could. The researcher or the assisting instructor supervised the transcription and collected both the transcripts and the shorthand notes.

The same procedures were followed for the second day of the preliminary testing. On the second day, however, two three-minute takes were dictated at 100 words per minute following a one-minute warmup.

Students who qualified to participate in the study were randomly assigned to one of six experimental groups. This grouping eliminated any

possible effects of using intact classes since the six groups were formed with equal numbers of students from each of the five shorthand classes. Sixteen subjects were assigned to each group.

The formation of six groups with equal numbers facilitated use of the Latin Square design. This design provided a systematic way to reduce possible effects of test order, inter-person variability, and inter-group variability. The four random 3 x 3 Latin Squares are shown in Figure 1.

The presentation order for the six study tests was determined in the Latin Square experimental design. Figure 1 shows that Version 1 of easy, average, and hard tests was randomly assigned to groups 1, 2, and 3 the first week (Square A), and Version 2 of the three levels was randomly assigned to the same three groups the second week (Square B). Groups 4, 5, and 6 were randomly assigned Version 2 of easy, average, and hard tests the first week (Square C) and Version 1 the second week (Square D). Use of the Latin Squares insured that each difficulty level occurred first, second, and third in each grouping and that each version of the tests occurred both first and second. Moreover, the design assured that all students took each of the six tests.

Both the researcher and the assisting instructor received a set of six individual cassette tapes (duplicated from master tapes) which contained the controlled instruments for this study. Each tape was coded and labeled so that the difficulty level of the test could not be recognized by the subjects (only the researcher knew the meaning of the codes.) Presentation orders using the codes were prescribed in advance for each of the six experimental groups.

Multiple-channel dictation equipment made it possible to administer six different tests simultaneously. Students were given the group number

Group 1 Group 2 Group 3

SQUARE A

H ₁	E ₁	A ₁
A ₁	H ₁	E ₁
E ₁	A ₁	H ₁

Group 4 Group 5 Group 6

SQUARE C

H ₂	E ₂	A ₂
E ₂	A ₂	H ₂
A ₂	H ₂	E ₂

SQUARE B

E ₂	A ₂	H ₂
A ₂	H ₂	E ₂
H ₂	E ₂	A ₂

SQUARE D

A ₁	H ₁	E ₁
H ₁	E ₁	A ₁
E ₁	A ₁	H ₁

Figure 1. Layout of Experimental Design

and matched with the appropriate presentation order. As a result, Group 1 students received Hard Test One first; Group 2 received Easy Test One first; Group 3 received Average Test One first; Group 4 received Hard Test Two first; Group 5 received Easy Test Two first; and Group 6 received Average Test Two first. The next five presentations followed the experimental design order. Students received one test per day. Since some classes met Monday, Wednesday, and Friday, it was not possible to test on consecutive days. However, students completed all six tests within two weeks of taking the first test.

Normal classroom atmosphere was maintained as nearly as possible. Any questions about the tests were answered in a very general manner, and students were assured that credit would be received for transcripts with passing scores. Students were not informed of the purpose of the tests. No previews or advance discussions of the tests were permitted. The instructors monitored the recording of the notes and the transcription. Students were encouraged to thoroughly read and edit their notes before transcribing. They were instructed to give both the transcript and the shorthand notes to the attending instructor.

Evaluation of Results

Each of the typewritten transcripts was hand scored by the researcher. Only shorthand errors on the transcript were counted, and one error per word was counted. Spelling, grammar, punctuation, capitalization, paragraphing, or typographical errors were not considered. Shorthand outline errors were not counted. The error score for each transcript was based on variations from the dictation, including words omitted, added, or substituted. The total number of errors was written

at the top of each transcript; the total was used as the raw transcription error score for the paper.

Score sheets (Appendix F) with spaces for students' identification numbers, group numbers, four preliminary test scores, and six study test scores were used to record each student's raw transcription error score for each test. A total of 576 transcripts were scored representing six transcripts from each of the 96 subjects.

Analysis of Data

Raw transcription error scores (Appendix G) were used to compute (1) raw mean transcription error scores for all subjects on each of the six tests and (2) raw mean transcription error scores for six groups on each of the six tests. An estimate of the intra-person variance component was computed for six groups for each of the three difficulty levels. The equality of all intra-person variances was tested by the Maximum F ratio test.

Three t-tests were computed to determine whether the average differences between the two tests at each difficulty level were statistically significant. The raw mean transcription error scores for the two tests at each of the three difficulty levels were averaged; and three additional t-tests were computed to test the statistical significance of differences between the averaged means of the easy, average, and hard difficulty level tests.

Summary

The procedures applied to collect and treat the data used to test the hypotheses of this study included the construction and administration

of six three-minute dictation tests. Two tests were constructed at each of three difficulty levels. Percentages of word occurrence indicated by the Perry (52) study were used to construct the average-level tests; average-level word frequency percentages were increased 10 percent to develop easy-level tests and decreased 10 percent for hard-level tests. Other factors held constant in the six tests were brief forms, brief form derivatives, syllabic intensity, number of actual words, and number of different words. All tests were tape recorded at 80 words per minute.

The population included Gregg Shorthand (Diamond Jubilee Series) students at Oklahoma State University during Fall Semester, 1980. The sample was selected by identifying students capable of recording at least 80 but less than 100 words per minute for three minutes. Ninety-six subjects were randomly assigned to one of six experimental design groups.

The presentation order for administration of the tests was determined by four random 3 x 3 Latin Squares. All subjects took six tests. Transcripts were hand scored by the researcher, and six transcription error scores were recorded for each subject.

Analysis of the data included the computation of three t-tests to determine whether the average error differences between the two tests at each difficulty level were statistically significant. Three additional t-tests were used to test the statistical significance of the averaged differences between each of the three difficulty levels.

CHAPTER IV

FINDINGS

Introduction

The primary purpose of this study was to determine the effect of word frequency on the difficulty of shorthand dictation material. Data for the study were obtained from the administration of six specially constructed shorthand dictation tests. Two tests were developed for each of three difficulty levels, and six tests were administered to all subjects. The sample consisted of 96 shorthand students at Oklahoma State University during Fall Semester, 1980. All subjects were capable of recording at least 80 but less than 100 words per minute on three-minute dictation pretests.

Findings of the study are based on estimates of intra-person variance. As a result of using four 3 x 3 Latin Squares, possible effects of test order, inter-person variability, and inter-group variability were reduced. The findings are based on relative rather than absolute differences in student performance.

The findings of the study are reported in three sections:

1. Preliminary Calculations
2. Determination of Equivalency of Two Tests at Three
Difficulty Levels
3. Determination of Differences Among Three Difficulty Levels

Preliminary Calculations

Raw Transcription Error Scores

Ninety-six subjects completed all six tests (two easy tests, two average tests, and two hard tests). Six raw transcription error scores were recorded for each subject representing one score per test. Appendix G contains a summary of the raw transcription error scores. Visual inspection of the scores revealed a tendency for transcription error scores to increase as the level of test difficulty increased.

Raw Mean Transcription Error Scores

Raw mean transcription error scores were calculated for each test. The error scores for each test (Appendix G) were summed, and the sums were divided by the number of observations (96). Table VII shows the raw mean transcription error scores for all subjects on two easy-level tests, two average-level tests, and two hard-level tests.

TABLE VII

SUMMARY OF RAW MEAN TRANSCRIPTION ERROR SCORES
FOR ALL SUBJECTS

<u>Easy</u>		<u>Average</u>		<u>Hard</u>	
<u>Test 1</u>	<u>Test 2</u>	<u>Test 1</u>	<u>Test 2</u>	<u>Test 1</u>	<u>Test 2</u>
28.05	18.79	36.42	43.69	56.17	63.31

Differences between raw mean transcription error scores for the two test versions at each difficulty level were greater than zero. Examination of the six raw mean transcription error scores indicated that more errors were made on average difficulty tests than on easy difficulty tests and that more errors were made on hard difficulty tests than on both easy and average difficulty tests.

In addition to raw mean transcription error scores for all subjects (Table VII), raw mean transcription error scores were calculated for the six groups. Raw transcription error scores (Appendix G) were reorganized by group numbers. The error scores were summed, and the sums were divided by the number of observations (16). Thirty-six means were calculated (one mean per test for each of the six groups). Table VIII is a summary of the raw mean transcription error scores for six groups.

TABLE VIII
SUMMARY OF RAW MEAN TRANSCRIPTION ERROR SCORES
FOR SIX GROUPS

Group	Easy		Average		Hard	
	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1	27.94	16.56	29.81	36.0	51.5	55.81
2	31.63	17.75	38.88	37.0	47.06	52.25
3	23.88	19.5	29.63	40.44	52.38	60.94
4	29.94	15.13	44.25	52.0	76.06	78.19
5	25.81	20.94	36.38	46.25	56.94	68.19
6	29.13	22.88	39.56	50.44	53.06	64.5

Estimate of the Intra-person Variance Component

Because of within-person differences, a person may not perform in an identical manner on two tests of the same type. Each of the 96 subjects took two easy-level tests, two average-level tests, and two hard-level tests. Therefore, the inconsistency in differences between each person's two scores for each difficulty level could be computed. This was used to estimate the intra-person variance component, which provided a measure of intra-person variability for each group of subjects at each difficulty level. The following formula was used to compute the estimate of intra-person variance for six groups:

$$\hat{\sigma}^2 = \frac{\left[\begin{array}{cc} N & N \\ \sum_{i=1}^N d_i^2 & - (\sum_{i=1}^N d_i)^2 \\ N & N \end{array} \right]}{2(N-1)}$$

As shown in Table IX, the three variance estimates computed for each of the six experimental groups represented one estimate of the intra-person variance component for each difficulty level. Some preliminary calculations were required before the intra-person variance component could be computed. Differences between the two error scores of each person, d_i , were computed at each difficulty level for all six groups; and the differences were summed, $\sum_{i=1}^{16} d_i$. Each difference value was squared, and squared differences were summed, $\sum_{i=1}^{16} d_i^2$. N equaled 16 for each group. Eighteen estimates of intra-person variability (six groups x three difficulty levels) were computed and averaged. The average obtained, $\hat{\sigma}^2 = 149.07$, was based on 270 degrees of freedom.

TABLE IX
ESTIMATES OF THE INTRA-PERSON VARIANCE COMPONENT
FOR SIX GROUPS

Group	Difficulty Level		
	Easy	Average	Hard
1	104.19	170.08	167.45
2	110.99	163.99	91.22
3	132.86	133.35	66.13
4	149.22	212.57	206.13
5	61.66	135.99	90.26
6	69.7	90.59	228.67

Maximum F ratio test

The 18 estimates of intra-person variability shown in Table IX had a range of 168.01. Using the Maximum F ratio test of the hypothesis for equality of all intra-person variances, the hypothesis could not be rejected at the .05 level of significance. Since there was little evidence against the hypothesis, it was assumed that the same variance was measured by all estimates.

Determination of Equivalency of Two Tests
at Three Difficulty Levels

The raw mean transcription error scores presented in Tables VII and VIII indicated that students made an average of 9.26 more transcription errors on Easy Test One than on Easy Test Two, an average of 7.27 more on Average Test Two than on Average Test One, and an average of 7.14 more on Hard Test Two than on Hard Test One. Three t-tests were used to determine whether the average performance differences between the two test versions at each difficulty level were statistically significant. The following computational formula was used to determine whether the average difference between the two easy-level tests was statistically significant:

$$t = \frac{\bar{Y}_{E1} - \bar{Y}_{E2}}{\sqrt{\frac{2 \cdot \hat{\sigma}^2}{96}}}$$

Raw mean transcription error scores for Easy Tests One and Two (Table VII) equaled \bar{Y}_{E1} and \bar{Y}_{E2} . The value of $\hat{\sigma}^2$, 149.07, is the average of all the estimates of the intra-person variance; and the number of observations in each mean equaled 96. Appropriate raw mean transcription error scores were substituted in the formula to compute t for (1) the two average-level tests and (2) the two hard-level tests. Table X shows results of the three t-tests of equivalency of two tests for each of the three difficulty levels.

TABLE X
t-TEST DETERMINATION OF EQUIVALENCY OF TWO TESTS
AT EACH OF THREE DIFFICULTY LEVELS

Degrees of Freedom	Computed t Value			t Value Required at .01 Level
	Easy	Average	Hard	
270	5.26	4.13	4.06	2.576

The tabled t value which is associated with statistical significance at the .01 level (for 270 degrees of freedom) was 2.576. Since the computed t for each of the three t-tests (easy tests, 5.26; average tests, 4.13; and hard tests, 4.06) was greater than 2.576, the average performance differences between two easy-level tests, two average-level tests, and two hard-level tests were considered statistically significant.

One objective of the study was to construct two tests of equivalent difficulty at each of three difficulty levels. The null hypotheses for determining the equivalency of two tests at each difficulty level (p. 11) stated that the average difficulty between two tests at each level would not be statistically significant. The three statistically significant t values indicated that average differences in transcription error scores would happen less than 1 percent of the time if there was in fact no difference in the average difficulty of the two easy-level tests, the two average-level tests, and the two hard-level tests. Thus, the null hypotheses associated with the determination of statistical equivalency of two tests at each of the three difficulty levels were rejected.

The statistically significant t values indicated that the two test versions at each difficulty level were not identically equated in difficulty level (not statistically equivalent). They did not infer that the two tests at each difficulty level were not of comparable difficulty within the respective difficulty levels. The two test versions at each difficulty level were judged of comparable difficulty because of the relatively small average differences between Easy Tests One and Two, Average Tests One and Two, and Hard Tests One and Two.

Determination of Differences Among Three Difficulty Levels

The raw mean transcription error scores shown in Table VII indicated performance differences between the three levels of test difficulty. Students averaged fewer errors on easy-level tests than on average-level tests and fewer errors on average-level tests than on hard-level tests. Three t-tests were used to test the statistical significance of the average differences among easy, average, and hard difficulty test levels.

Before t was computed for each level, the two raw mean transcription error scores (Table VII) for each difficulty level were averaged. The three averaged means are shown in Table XI.

The following computational formula was used for the t-test of average difference between the average and easy difficulty levels:

$$t = \frac{\bar{Y}_A - \bar{Y}_E}{\sqrt{\frac{2 \cdot \hat{\sigma}^2}{192}}}$$

TABLE XI
 AVERAGED RAW MEAN TRANSCRIPTION ERROR SCORES
 FOR ALL SUBJECTS

Difficulty Level	Test 1 Mean	Test 2 Mean	Averaged Mean
Easy	28.05	18.79	23.42
Average	36.42	43.69	40.06
Hard	56.17	63.31	59.74

Averaged raw mean transcription error scores (Table XI) for the average and easy difficulty levels were used to compute $\bar{Y}_A - \bar{Y}_E$. The value of $\hat{\sigma}^2$, 149.07, is the average estimate of the intra-person variance. The number of observations equaled 192 (96 subjects x 2 tests at each level). The denominator of the formula is an estimate of the standard deviation of the difference between the averaged means of the average-level tests and the easy-level tests.

The t-test was repeated using appropriate data to determine the statistical significance of differences between the averaged means of (1) hard and average difficulty levels and (2) hard and easy difficulty levels. Results of the three t-tests are presented in Table XII.

Computed t values were compared against the tabulated t value at the .01 level with 270 degrees of freedom. Each of the three computed t values exceeded the 2.576 critical value. Therefore, the differences among the averaged raw mean transcription error scores for the easy,

average and hard difficulty level tests were considered statistically significant.

TABLE XII

t-TEST DETERMINATION OF DIFFERENCES AMONG
THREE LEVELS OF DIFFICULTY

Difficulty Levels Compared	Observed Difference	Computed t Value
Average - Easy	16.64	13.31
Hard - Average	19.68	15.74
Hard - Easy	36.32	29.06

The objective was to construct dictation tests at three different levels of difficulty by varying percentages of frequently used words. Students made an average of 16.64 more transcription errors on the average-level tests than on the easy-level tests, an average of 19.68 more on hard-level tests than on average-level tests, and an average of 36.32 more on hard-level tests than on easy-level tests.

The null hypotheses (p. 11) stated that statistically significant differences would not be found among the three difficulty levels. Three statistically significant t values indicated that differences among averaged mean transcription error scores would happen 1 percent of the time or less if the hypothesis of equality of the population means was true.

Therefore, differences among the averaged mean transcription error scores for easy, average, and hard difficulty levels were judged to be repeatable differences. Null hypotheses associated with determination of average differences among three difficulty levels were rejected.

In addition to determining statistically significant average differences among the three test levels, the *t* values further indicated that the two test versions at each difficulty level were of comparable difficulty. The average transcription error score differences among the three test levels (easy-average, 16.64; average-hard, 19.68; and hard-easy, 36.32) were large differences in comparison to the average differences between the two test versions at each difficulty level (Easy Tests One and Two, 9.26; Average Tests One and Two, 7.27; and Hard Tests One and Two, 7.14). The results showed distinct average transcription error score differences among the three test levels, and relatively small average differences between the two test versions at each of the three difficulty levels.

Summary

Findings of this study are based on an analysis of mean transcription error scores obtained from the administration of six specially constructed three-minute dictation tests. The data were collected and treated to determine (1) whether differences between mean transcription error scores for two tests at each difficulty level were statistically significant and (2) whether there were statistically significant differences between averaged mean transcription error scores on easy versus average, average versus hard, and easy versus hard difficulty level tests.

Three t-tests were used to compare average differences between the mean transcription error scores for Easy Test One and Easy Test Two, Average Test One and Average Test Two, and Hard Test One and Hard Test Two. Statistically significant t values were computed for each of the three comparisons. The two test versions at each difficulty level were not statistically equivalent (not identically equated in difficulty). However, the two tests at each difficulty level were judged of comparable difficulty within respective difficulty levels.

Three additional t-tests were used to test the statistical significance of the average differences among transcription error scores for easy-level tests, average-level tests, and hard-level tests. Three resulting t values exceeded the critical value and indicated statistically significant differences between each of the three difficulty levels. The average-level tests were more difficult than the easy-level tests, and the hard-level tests were more difficult than both the easy- and average-level tests.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Shorthand dictation materials are not equated in difficulty levels by any reliable measure. Instructors and researchers have long recognized the need for valid, reliable methods for determining the difficulty of dictation materials used for practice and measurement purposes. Numerous researchers have attempted to identify determinants of copy difficulty and have slowly expanded the scientific basis for equating the difficulty of shorthand dictation materials.

Word frequency has been mentioned in shorthand literature as a probable determinant of the difficulty of dictation material, and it has been cited as a more accurate measure of difficulty than syllabic intensity. Most researchers have recommended further investigation of the relationship between word frequency and copy difficulty. This study sought to further identify criteria that could be used to develop shorthand dictation material of predictable difficulty levels based on word frequency.

Assuming that Perry's list of most frequently used words provided a valid indication of the frequency of word occurrence in business correspondence, answers were sought to two research questions:

1. Can the difficulty level of dictation material be changed by varying word occurrence percentages for frequently used word categories of the Perry (52) word list while holding constant

brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words?

2. Can shorthand dictation materials of equivalent difficulty levels be developed by controlling percentages of words listed in seven frequency categories of the Perry (52) word list while holding constant brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words?

Using six three-minute dictation tests written for this study, three null hypotheses were tested to determine whether shorthand dictation materials of statistically equivalent difficulty could be constructed.

The null hypotheses were as follows:

1. There is no statistically significant difference in average difficulty between two easy-level tests as measured by average transcription error scores.
2. There is no statistically significant difference in average difficulty between two average-level tests as measured by average transcription error scores.
3. There is no statistically significant difference in average difficulty between two hard-level tests as measured by average transcription error scores.

Three additional null hypotheses were tested to determine whether the difficulty level of shorthand dictation material could be significantly changed by varying word occurrence percentages of frequently used word categories. The null hypotheses were as follows:

1. There will be no statistically significant difference in mean transcription error scores between easy-level tests and average-level tests.
2. There will be no statistically significant difference in mean transcription error scores between average-level tests and hard-level tests.
3. There will be no statistically significant difference in mean transcription error scores between easy-level tests and hard-level tests.

A review of the literature related to copy difficulty revealed that numerous studies had sought to identify factors to predict and/or measure the difficulty of shorthand dictation material. However, no valid and/or reliable method for equating copy difficulty levels has been determined.

Syllabic intensity has been the most commonly used measure of copy difficulty. Some defense for the syllabic intensity measure of difficulty was offered by Leslie (37), Elsen (13), Hillestad (23), and Wedell (78). However, most studies using this factor concluded that syllabic intensity was an inconsistent and/or inadequate determinant of the difficulty of dictation material.

Other factors have been examined as possible copy difficulty determinants. Two researchers concluded that shorthand stroke intensity and shorthand stroke count were helpful predictors of copy difficulty (65) (78). However, others reported that stroke intensity and stroke count were not significantly related to difficulty. Sentence length, average word length, and some readability formulas were also reported as weak predictors of copy difficulty. Both Hillestad and Uthe (76) developed multiple regression prediction equations for determining copy difficulty;

however, subsequent attempts to validate the formulas were generally unsuccessful.

Word frequency and vocabulary indexes based on listings of frequently used words compiled by Horn (25), Horn and Peterson (26), Silverthorn (67), Perry (52), and Mellinger (45) have been used as factors in a number of copy difficulty studies. Conclusions of most studies defended the hypothesized relationship between word frequency and copy difficulty. Several researchers provided evidence which supports the premise that low-frequency words have the greatest impact on copy difficulty (6) (23) (44) (47) (78) (80). Most researchers recommended further investigation of the relationship between word frequency and the difficulty of dictation material.

Procedures applied to collect and treat data used to test the hypotheses of this study included construction of six shorthand dictation tests. Two three-minute dictation tests were developed at each of three difficulty levels (easy, average, and hard).

Two tests classified as average contained word occurrence percentages identified by Perry (52). Ten percent more high-frequency and common words were used in the two easy-level tests; the two hard-level tests contained 10 percent fewer high-frequency and common words.

Factors held constant in the six tests were percentage of brief forms and brief form derivatives, syllabic intensity, number of different words, and number of actual words. Internal consistency of the tests was maintained by controlling these factors for each one-minute segment of each test as well as for all three minutes of each test. Additionally, the contents of each test pertained to a business issue.

Composition analyses of the six tests (Appendix C) revealed that all tests contained approximately 44.73 percent and 3.16 percent respectively brief forms and brief form derivatives. Syllabic intensity of 1.5 was held constant for all tests, and the tests were paced with a 1.5 standard word. Each one-minute segment contained 80 actual words; each three-minute test contained 240 actual words. The number of different words used in each test ranged between 143 and 155.

The six test tapes were professionally recorded at the Oklahoma State University Audio-Visual Center. Each tape contained instructions to students, a one-minute warmup dictation, and one three-minute test at 80 words per minute.

The sample was drawn from five Gregg (Diamond Jubilee Series) shorthand classes at Oklahoma State University during the fall semester, 1980. Selection of subjects and verification of their ability to record at least 80 but less than 100 words per minute were made by means of a two-day pretest. Pretest materials were adapted from published tests by Gregg McGraw-Hill. Syllabic intensity and the standard shorthand word of the pretests were revised to 1.5 to match the pacing of the six study tests. Students were included in the study if they passed at least one 80 word per minute take with 95 percent accuracy but did not pass either of the 100 word per minute takes.

Four 3 x 3 Latin Squares were developed for the experimental design of the study. As a result of using Latin Squares, possible effects of test order, inter-person variability, and inter-group variability were reduced. Each test occurred once in first, second, and third position. The two test versions at each difficulty level were arranged in opposing order so that each version was given both first and second. Test tapes

were coded and labeled so that the difficulty level could not be recognized by the subjects.

After qualifying on the pretests, 96 students were randomly assigned to one of six experimental groups. Sixteen subjects were randomly assigned to each group. The group assignments determined the order in which each group received the tests since the presentation orders had been randomized by the four 3 x 3 Latin Squares.

Multiple-channel dictation equipment was used to administer the tests so that the six different tests could be administered simultaneously as required by the Latin Square design. Tests were administered three times per week for two weeks. Guidelines for administering the tests (Appendix D) were followed by the researcher and one other instructor. Subjects received one easy-level, one average-level, and one hard-level test in randomized order each week.

All transcripts were hand scored by the researcher. Raw transcription error scores were recorded for 576 transcripts. Only shorthand related errors on the transcripts were counted.

Findings of the study are based on intra-person variance. Six raw transcription error scores were recorded for 96 subjects. Raw mean transcription error scores were calculated for all six tests using $N = 96$. In addition, raw mean transcription error scores were calculated for each of the six groups using $N = 16$. In each instance, observable differences were noted both between the two test versions at each difficulty level and among the three levels of difficulty.

An estimate of the intra-person variance component was computed to provide a measure of the intra-person variability for each group of students for three levels of test difficulty. Three variance estimates

were computed for each of the six experimental groups representing one estimate for each test level. The 18 estimates were averaged to obtain the average estimate of intra-person variance. The Maximum F ratio test was used to test the hypothesis of the equality of all intra-person variances. The hypothesis could not be rejected at the .05 level of significance.

Three t-tests were used to determine whether the average performance differences between two test versions at each difficulty level were statistically significant. The tabled t value which was used to determine statistical significance at the .01 level (for 270 degrees of freedom) was equal to 2.576. The three computed t values (easy-level tests, 5.26; average-level tests, 4.13; and hard-level tests, 4.06) exceeded the critical value. Since the computed t values were considered statistically significant, null hypotheses associated with determination of equivalency of two tests versions at each of three difficulty levels (p. 11) were rejected. The two test versions at each difficulty level were judged of comparable difficulty, however.

Three additional t-tests were used to determine whether the observed differences among averaged mean transcription error scores for tests of three difficulty levels were statistically significant. The computed t values were compared against the critical t value. Each computed t value (average - easy, 13.31; hard - average, 15.74; and hard - easy, 29.06) exceeded the 2.576 critical value. Average differences among the easy, average, and hard difficulty levels were considered statistically significant. Therefore, null hypotheses associated with determination of average differences between three difficulty levels (p. 11) were rejected.

Conclusions

The study problem was stated in two research questions (p. 10). The following conclusions are based on the findings and relate to the two research questions:

1. The difficulty level of shorthand dictation materials can be changed by a 10 percent increase or decrease in word occurrence percentages for frequently used word categories of the Perry (52) word list while holding constant brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words.
2. The two test versions at the easy, average, and hard difficulty levels were not statistically equivalent. Comparisons were made between tests that contained the same percentages of words from seven different word frequency categories; equal percentages of brief forms and brief form derivatives; a constant syllabic intensity; the same number of actual words; and approximately the same number of different words. Students averaged 9.26 more transcription errors on Easy Test One than on Easy Test Two, 7.27 more on Average Test Two than Average Test One, and 7.14 more on Hard Test Two than on Hard Test One.

The findings showed that the two test versions at each difficulty level were not identically equated in difficulty (not statistically equivalent). The differences in average transcription error scores between the two easy-level, average-level, and hard-level tests (9, 7, and 7, respectively) were statistically significant differences which could be expected to occur again if the tests were repeated. Even though the two tests at each level of difficulty were not identically equated in

difficulty, the relatively small average differences between the two test versions at each difficulty level indicated that the tests were comparable within respective difficulty levels. The large, statistically significant average transcription error score differences among the three levels of difficulty also supported the comparability of the two test versions at each difficulty level.

Recommendations

Findings of the study are based on relative data rather than absolute scores. Students averaged 9 more errors on Easy Test One than on Easy Test Two; 7 more errors on Average Test Two than on Average Test One; and 7 more errors on Hard Test Two than on Hard Test One. The average number of transcription errors increased as the level of test difficulty increased. Students averaged 17 more errors on average-level tests than on easy-level tests, 20 more errors on hard-level tests than on average-level tests, and 37 more errors on hard-level tests than on easy-level tests.

The conclusions of the study included: (1) average differences between the three levels of difficulty were statistically significant; and (2) the two test versions at each of the three difficulty levels were not statistically equivalent. The two test versions at each difficulty level were comparable within respective difficulty levels, however. As a result of the findings, recommendations for further study were generated.

1. Efforts should be continued to refine methods for developing shorthand dictation materials of comparable difficulty. Identically equated shorthand dictation materials are not possible. However, a range of acceptable comparability should be established. In doing so,

researchers and teachers must decide whether shorthand dictation materials at given difficulty levels should be statistically equivalent or simply within a comparability range. For example, Thomason (70) developed two hard-level dictation tests which were statistically equivalent even though students averaged three more transcription errors on Hard Test One than on Hard Test Two. The hard-level tests developed for this study were not statistically equivalent; however, they were judged of comparable difficulty even though students averaged 7 more errors on Hard Test Two than on Hard Test One. The Thomason (70) study and the present study provided evidence that dictation materials can be developed and classified at various levels of difficulty and comparability. More research is needed to relate the findings of the two studies to the classroom setting and to determine the level of precision required in order to obtain valid and reliable measures of student achievement.

2. Shorthand dictation materials of predictable difficulty levels should be written and used for practice and measurement purposes. General classifications of easy, average, and hard difficulty levels would reduce many of the uncertainties of copy difficulty. Dictation materials of average difficulty (developed with word frequency percentages identified for average correspondence) could be used as the standard for three-minute dictation tests. Materials of easy, average, and hard difficulty levels could be correlated with the simple to complex progression of skill development.

3. Most shorthand teachers use printed dictation materials prepared by publishers of shorthand systems. Publishers should assume an active role in developing shorthand dictation materials of predictable difficulty levels. They should apply the available research findings to write

and classify shorthand dictation materials of comparable difficulty levels. A descriptive difficulty notation should be printed on dictation materials.

4. Syllabic intensity was held constant for each one-minute segment of the six study tests as well as for all three-minutes of each test. Numerous content changes were required in order to achieve the 1.5 syllabic intensity goal for all six tests. The original syllabic intensity of the six tests (after the initial writing) was about 1.8. Some contextual continuity was lost during syllabic intensity revisions, and portions of the tests seemed somewhat contrived. Syllabic intensity has been identified as an inadequate index of copy difficulty by numerous researchers [Wellman (79), Flood (15), Curtin (7), Turse (75), Uthe (76), Hillestad (23), Mellinger (45), Mickelsen (47), Pullis (56, 57), Henrie (20), and Nickerson (49)]. Therefore, the syllabic intensity factor need not be held constant in shorthand dictation materials. Researchers and writers should pace dictation materials by the standard shorthand word of 1.4 syllables and allow syllabic intensity to vary with the natural flow of the communication. Extremely high and extremely low syllabic intensity measures should be avoided, however.

5. Comparable shorthand dictation materials can be developed at significantly different levels of difficulty by controlling percentages of frequently used words, percentages of brief forms and brief form derivatives, syllabic intensity, number of actual words, and number of different words. The 10 percent variance from average word occurrence percentages used for this study did produce comparable dictation materials at three significantly different levels of difficulty. However, the 10 percent variance may not be the best choice since cumulative

percentages of words frequently translated into small numbers of words. As is shown in the composition analyses of the six tests (Appendix C), as few as two and three words were used to represent some word frequency categories. Thomason (70) was able to develop statistically equivalent dictation tests at three significantly different levels of difficulty by using a 15 percent variance from average-level word occurrence percentages. Therefore, a variance range of 10 to 15 percent is recommended. Shorthand dictation materials should be developed using the following controls: (a) word occurrence percentages identified by Perry (52) for written business correspondence should be used to develop average-level takes, and the percentages should be increased 10 to 15 percent for easy-level takes and decreased 10 to 15 percent for hard-level takes; (b) takes should contain approximately 44.73 percent brief forms and 3.16 percent brief form derivatives as recommended by Reese and Smith (63) for written business correspondence; (c) 80 actual words per minute, and 240 actual words per three-minute take; (d) approximately the same number of different words; and (e) syllabic intensity ranges which vary with the natural flow of the communications without averaging extremely high or extremely low measures. Shorthand dictation materials should be paced by the standard shorthand word of 1.4 syllables. Word frequency percentages and percentages of brief forms and brief form derivatives should be revised, if necessary, as subsequent word frequency studies are conducted.

6. Students' reactions to the dictation materials and procedures used for this study may be helpful to future researchers. For this study, possible variance in dictation style and timing was controlled by using the same dictator for all tests and by tape recording the tests. The professional narrator who recorded the tests was not knowledgeable of

shorthand systems or shorthand teaching methodologies. Therefore, dictation was paced at a steady rate without grouping words into commonly written thought phrases, as shorthand teachers have a tendency to do. Students commented that the dictation seemed more difficult without the advantage of being able to "hear" thought phrases. A different dictation style might have reduced transcription errors by facilitating more accurate shorthand writing. Possible interaction between dictation style and use of controlled copy should be investigated.

7. Students also observed that the content of each letter was different. For example, Easy Test One discussed business credit, and Easy Test Two pertained to medical insurance. For purposes of this study, subject matter was varied to prevent vocabulary rehearsal from one test to another. A study should be conducted to determine possible effects of using tests controlled for similar vocabulary, word frequency categories, brief forms, brief form derivatives, syllabic intensity, number of different words, and number of actual words.

8. Intra-person variability is difficult to control and to estimate. The sample for this study included students capable of recording dictation at 80 but less than 100 words per minute. Some students were struggling to write 80 words per minute with 95 percent accuracy while others were writing almost 100 words per minute. When identifying subjects, future researchers might profit from using other controls for intra-person variability that would establish additional performance criteria within pretest qualifying ranges. For example, students could be grouped by pretest error scores or smaller skill ranges such as 80 to 90 words per minute.

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APPENDIX A

FORM USED TO RECORD AND TABULATE THE NUMBER
OF WORDS NEEDED AND/OR USED IN
EACH CATEGORY CONTROLLED

Factors	Color Code	Goal	Actual
1-100	Red		
101-500	Green		
501-1,000	Black		
1,001-1,500	Brown		
1,501-2,500	Dark Blue		
2,501-5,000	Gray		
Over 5,000	Lead Pencil		
Brief Forms	Light Blue		
Brief Form Derivatives	Double Black		
Actual Words			
Different Words			
Syllabic Intensity			

APPENDIX B

TEST INSTRUMENTS DEVELOPED FOR THIS STUDY

EASY DIFFICULTY LEVEL STUDY TEST

Version One

MR. LAKES

WHEN YOU WROTE US LAST WEEK FOR CREDIT, WE IMMEDIATELY ASKED THE BUSINESS CREDIT UNION OFFICE FOR YOUR / INFORMATION. YOU CAN BE PROUD OF THE OUTSTANDING LETTER WE RECEIVED, SHOWING NOT A BLACK MARK AGAINST YOU. SUCH A COM / PLIMENTARY REPORT ON YOUR DEVELOPMENT SHOULD REFLECT A SUCCESSFUL FUTURE, AND THE FACT THAT YOU HAVE NEVER HAD / A PROBLEM CLOSING AN ACCOUNT MAY MEAN THAT YOU WILL BE ABLE TO USE NEW CREDIT WHEN YOUR SALES BECOME REGULAR. (1)

WE COULD OFFER THE PRODUCTS TO YOU ON THE BASIS OF YOUR PROGRESS RECORD. WE KNOW THAT YOU DO INTEND TO MEET THE OB / LIGATIONS YOU ASSUME; BUT IF AN UNUSUAL EXPENSE SHOULD COME UP, YOU PROBABLY COULD NOT SUPPORT YOUR ACCOUNT WITH / YOUR PRESENT INCOME. AS A CERTIFIED MEMBER OF THE CREDIT UNION, WE WOULD BE REQUESTED TO SUBMIT YOUR NAME AS / A DEFINITE RISK. SUCH A REPORT WOULD FOLLOW YOU WHEN SEEKING OTHER OPPORTUNITIES IN THE FUTURE--PERHAPS AT (2) A TIME WHEN YOUR CORPORATION NEEDS IT MORE THAN NOW. FOR YOUR OWN BENEFIT, YOU WILL BETTER OFF TO PURCHASE WITH CASH. /

THANK YOU FOR WRITING TO US. I SHALL LOOK FORWARD TO THE TIME WHEN YOU CAN DEFINITELY RECEIVE CONSIDERATION FOR / TOTAL SERVICE. CURRENTLY, YOU CAN MAKE YOUR DOLLARS EXTEND FURTHER BY PURCHASING WITH CASH FOR WE CAN DELIVER IN / QUANTITY AND SAVE ON TRANSPORTATION COSTS. WE PASS THESE SAVINGS ON IN THE FORM OF REASONABLE PRICES. SINCERELY (3)

EASY DIFFICULTY LEVEL STUDY TEST

Version Two

GOVERNOR

WE CALLED YOUR PERSONAL OFFICE DURING THE PAST WEEK, AND YOUR SECRETARY INDICATED THAT YOU WOULD BE / ON VACATION FOR A MONTH. SINCE WE HAVE BEEN UNABLE TO TELEPHONE YOU, I AM WRITING TO GIVE YOU THE ANALY / SIS REPORT OF THE OTHER TWO TESTS I PERFORMED. BOTH TECHNICAL REPORTS WERE VERY NORMAL, AND YOU HAVE NOTHING TO BE / CONCERNED ABOUT. I AM SURE THAT THIS IS WONDERFUL NEWS.

YOU SUGGESTED DURING YOUR LAST BRIEF VISIT TO MY OFFICE THAT (1) YOU WERE CONSIDERING HAVING A SUBSEQUENT PHYSICAL EXAMINATION. FILE RECORDS SHOW THAT YOUR LATEST EXAM / INATION WAS SIX YEARS AGO. IF YOU ARE INTERESTED IN DOING SO, YOU SHOULD PLAN TO DO IT QUICKLY.

I SUGGEST / THAT YOU SCHEDULE SOME DAYS IN A PRIVATE HOSPITAL FOR AUTHORIZED TESTS. IN THIS WAY, MOST OF THE TESTS CAN BE FINISHED IN / A PERIOD OF TWO DAYS. OTHERWISE, YOU MAY HAVE TO MAKE AN APPOINTMENT WITH OUR OFFICE AT LEAST FIVE TIMES IN ORDER (2) FOR OUR LABORATORY TO DO THE BEST HEART TESTS. ALSO, YOUR PRESENT MEDICAL INSURANCE WILL COVER ANY OF / THE EXPENSES. THE PLAN WOULD PAY ONLY PART OF THEM IF I DID THE FULL PROCESS HERE IN THIS OFFICE.

PLEASE CALL MY NURSE SOME / TIME THIS WEEK AND LET US KNOW IF YOU WISH TO PROCEED IMMEDIATELY WITH THIS IDEA. IF YOU CHOOSE TO HAVE THE GEN / ERAL PHYSICAL EXAMINATION, WE WILL BE GLAD TO MAKE THE RESERVATIONS FOR A CONVENIENT TIME. SINCERELY (3)

AVERAGE DIFFICULTY LEVEL STUDY TEST

Version One

DEAR MRS. ENGLISH

THE ENCLOSED BOOKLET OFFERS THE REAL STORY ABOUT THE WAY OUR AIRLINE THINKS YOU SHOULD TRAVEL. WE ARE / SURE THAT YOU WILL LIKE WHAT WE HAVE TO SAY BECAUSE YOU ARE AN INFORMED TRAVELER AND REALIZE THAT GETTING FROM ONE PLACE / TO ANOTHER CAN BE EITHER A GOOD OR BAD EXPERIENCE.

WE ARE ABOUT TO PREVIEW SEVERAL CUSTOMER SER / VICES AND SPECIAL TICKETS WHICH WILL IMPROVE THE FLYING SITUATION. THESE NEW SERVICES WILL MAKE FLYING WITH US SEEM (1) MORE WONDERFUL THAN IT HAS BEEN IN THE PAST. OUR PRESENT IDEAS FOR CHANGES ARE: SCHEDULED SERVICE INTO THE CITIES / FROM THE AIRPORT; BETTER FREIGHT HANDLING DURING LOADING; NEW TIME AND INFORMATION SERVICE; AND AN EXPRESS SERVICE TO THE / ENTRANCE FROM THE GOOD HOTELS. FOOD WILL BE SERVED DURING EVERY FLIGHT, AND THOSE TRAVELING FIRST CLASS WILL BE ABLE TO ORDER / THEIR DINNER FROM A GREAT MENU. EXPERIENCED ATTENDANTS WILL GLADLY PLEASE EVERY CLIENT AND WORK TO MAKE THEM HAPPY. (2) BE SURE TO WATCH FOR NEWSPAPER ADVERTISEMENTS OF VARIOUS WEEKEND EXCURSIONS.

THIS IS A SAMPLE OF WHAT WE OF / FER ESTABLISHED CLIENTS. WE HOPE THAT YOU WILL ENJOY LOOKING THROUGH THE ENCLOSED BOOKLET AND THAT YOU WILL BE ABLE TO RE / SERVE ADDITIONAL FLIGHTS WITH US SOON. IF YOU WOULD LIKE FOR US TO ASSIST WITH THE ARRANGEMENTS FOR YOUR NEXT TRIP, CALL AND ONE / OF OUR TELEPHONE RESERVATIONS CLERKS WILL BE HAPPY TO HELP YOU SCHEDULE EXCEPTIONAL TRAVEL PLANS. SINCERELY YOURS (3)

AVERAGE DIFFICULTY LEVEL STUDY TEST

Version Two

DEAR MR. JONES

OUR BENEFITS PROGRAM WILL BE REVISED AGAIN DURING THE COMING MONTH. WE WERE FLATTERED TO LEARN RECENT / LY THAT A STUDY OF PERSONNEL POLICIES OF MAJOR COMPANIES SHOWED THAT OUR BUSINESS IS GREATLY ADVANCED OVER / MOST IN THE CASE OF VITAL BENEFITS. WE ARE VERY PROUD OF THESE FINDINGS AND SHALL MAKE EVERY EFFORT TO SUSTAIN OUR / LEAD.

AS A RESULT OF YOUR INTEREST AND RESEARCH, PROFITS LAST YEAR WERE MUCH HIGHER THAN ANY OTHER YEAR ON RECORD. (1) WE WANT TO SHARE THIS ADDED REVENUE WITH OUR STAFF IN THE FORM OF GROUP BENEFITS. THIS IS OUR WAY OF THANKING OUR DE / VOTED EMPLOYEES FOR THEIR CONTRIBUTION TO OUR COMPANY'S SUCCESS. WE ARE VERY GLAD TO HAVE YOU ON OUR STAFF AND / TRUST THAT THE NEW PROGRAM WILL CONVINCEN YOU OF OUR SUPPORT FOR PROFIT SHARING WITH WORTHY EMPLOYEES.

THE NEW PROPOSALS / EXTEND OUR RECOGNIZED PLAN FOR DIVIDING PROFITS, AS WELL AS FAMILY HEALTH, DENTAL, AND LIFE INSURANCE COVERAGE. (2) ADDED TO YOUR FIRST BONUS RAISE, FRINGE BENEFITS MAY EQUAL A SWIFT INCREASE IN YOUR SALARY.

THE FULL PLAN IS DESCRIBED / IN DETAIL IN THE ENCLOSED PUBLICATION. STAFF MEMBERS WHO HAVE BEEN EMPLOYED FOR AT LEAST ONE YEAR ARE ELIGIBLE. A / SHARE OF THE COMPANY'S RESERVES WILL BE PLACED IN YOUR OWN ACCOUNT EACH FISCAL YEAR, AND ALL OF YOUR INSURANCE PREMIUMS / WILL BE PAID BY THE COMPANY. PLEASE DIRECT QUESTIONS ABOUT THE BENEFITS TO THE PERSONNEL SECTION SOON. CORDIALLY (3)

HARD DIFFICULTY LEVEL STUDY TEST

Version One

DEAR MRS. KEY

THANK YOU FOR PROMPTLY SENDING PACKETS OF BOOKLETS COVERING THE CLASSES YOU PRESENT. I DELIVERED COP / IES THROUGH BOTH OF OUR DISTRICT MANAGERS, AND THE PANELS DISCUSSED THEM LAST FRIDAY MORNING.

OUR STAFF AGREED TO PROMOTE YOUR / SUPERB TRAINEE SEMINAR FOR WOMEN WHO ARE UPPER MANAGEMENT POTENTIALS. A COUPLE OF OUR FEMALE GROUPS HAVE BEEN / WITH US FOR MANY YEARS AND HAVE STAYED IN THE OFFICES BY WHICH THEY WERE HIRED AS STENOGRAPHERS. THESE LADIES GIVE A GREAT (1) DEAL TO OUR BUSINESS AND ITS SALES. WE ARE PURSUING THE IDEA OF HAVING YOU GIVE YOUR FULL WOMEN IN MANAGEMENT / SEMINAR FOR THE PURPOSE OF LEADERSHIP GROWTH WITHIN OUR FEMALE STAFF MEMBERS. PLEASE SEND A LIST OF OPEN DATES. OUR CON / FERENCE ROOM HAS PLENTY OF SEATING, AND IT HAS PROJECTORS AND COMMON INSTRUCTIONAL AIDS. I WILL DO THE PROMOTING / AND PUBLISH A PROGRAM AFTER THE DATES ARE APPROVED.

WHEN SCANNING YOUR BROCHURES, THE WOMEN LISTED VALID TOPICS WHICH SHOULD (2) BE DISCUSSED OPENLY. WHEN YOU CAN, RELATE THEM DURING THE SESSIONS. WE WILL ACCEPT YOUR OWN JUDGMENT, HOWEVER.

THE FIRST / PAYMENT CHECK IS ENCLOSED. AS OUTLINED IN THE TERMS OF THE CONTRACT, I WILL SEND AN EQUAL AMOUNT AFTER EACH SESSION AND / REPAY ROUTINE TRAVEL CLAIMS.

I WILL WANT TO SPONSOR A BIG RECEPTION SOON TO AROUSE EXCITEMENT AND TO PREDICT THE / NUMBER OF WOMEN THAT WILL ATTEND THE SEMINAR. WE WILL SET YOU PAINTED POSTERS IN VISIBLE PLACES. SINCERELY (3)

HARD DIFFICULTY LEVEL STUDY TEST

Version Two

DEAR MRS. JONES

MY PRIOR CLERICAL WORK EXPERIENCE AND FOUR YEARS OF COLLEGE CLASSES IN COMMERCIAL SUBJECTS WILL / ENABLE ME TO SERVE YOU WELL AS A VALUED SECRETARY AND ADVANCE THE RELATIONS BETWEEN YOU AND YOUR CLOSE PA / TRONS.

WHETHER YOU WISH TO SEND AN INVENTIVE MASS SALES MEMO, A SUBTLE REMINDER TO REVIVE YOUR ACCOUNTS, OR AN EF / FECTING LETTER FOR THE MAIN OFFICE, I COULD HAVE A PRECISE COPY AT YOUR DESK FOR SIGNING IN A SHORT TIME. WHILE EARNING (1) A BACHELOR OF SCIENCE DEGREE, I GAINED THE COMPETENCE TO RECORD DICTATION AT HIGH SPEEDS AND TRANSCRIBE THE NOTES WITH / STRIKING SUCCESS. I HAVE USED THOSE SKILLS ADEPTLY DURING THE PAST FOUR YEARS.

IN ORDER TO HELP WITH THE DIVERSE KINDS OF DE / MANDS OF A LARGE INSURANCE BUSINESS, I CAN USE THE TRAINING FROM FOUR SEMESTERS OF ACCOUNTING COURSES AND THE MASTERY / OF RECORDS MANAGEMENT, OFFICE PRACTICES, AND DESK COMPUTERS. YOU CAN TRUST ME TO ORGANIZE AND COMPUTE MONTHLY RATES (2) FOR PREMIUMS, MAIL STATEMENTS ON TIME, AND DEVISE AND TURN OUT SPECIAL FORMS AS REQUIRED.

IT SEEMS THAT IN A RENOWNED INSUR / ANCE AGENCY EACH PERSON FROM THE MANAGER THROUGH THE ACCOUNTANT AFFECTS THE MOODS OF THE PUBLIC AND THAT WE MUST USE / FRIENDLINESS AND TACT IN HAVING CONTACTS WITH THE CLIENTELE.

I AM PREPARED TO MEET A NUMBER OF TASKS AND ADAPT TO / BUSY WORK SCHEDULES. THE FOUR REFERENCES I HAVE LISTED WILL GLADLY CONFIRM THAT I PERFORM CHEERFULLY. SINCERELY (3)

APPENDIX C

COMPOSITION ANALYSES OF THE SIX
TEST INSTRUMENTS DEVELOPED
FOR THIS STUDY

TABLE XIII
 COMPOSITION ANALYSIS OF EASY DIFFICULTY LEVEL STUDY TEST
 Version One

Factors	Goal		Actual						
	1 Min.	3. Min.	Min. 1	+	Min. 2	+	Min. 3	=	3 Min.
Word Groups:									
1-100	47.02	141.06	47	+	47	+	47	=	141
101-500	16.28	48.84	16	+	16	+	17	=	49
501-1,000	7.7	23.05	8	+	8	+	7	=	23
1,001-1,500	4.33	12.99	4	+	4	+	5	=	13
1,501-2,500	4.69	14.07	5	+	5	+	4	=	14
2,501-5,000	<u>0</u>	<u>0</u>	—		—		—		—
Actual Words	<u>80.0</u>	<u>240.0</u>	<u>80</u>	+	<u>80</u>	+	<u>80</u>	=	<u>240</u>
Brief Forms	35.78	107.34	36	+	36	+	35	=	107
Brief Form Derivatives	2.53	7.59	3	+	3	+	2	=	8
Syllabic Intensity	1.5	1.5	1.5		1.5		1.5		1.5
Number of Different Words	143-155								143

TABLE XIV
COMPOSITION ANALYSIS OF EASY DIFFICULTY LEVEL STUDY TEST
Version Two

Factors	Goal		Actual						
	1 Min.	3. Min.	Min. 1	+	Min. 2	+	Min. 3	=	3 Min.
Word Groups:									
1-100	47.02	141.06	47	+	47	+	47	=	141
101-500	16.28	48.84	16	+	16	+	17	=	49
501-1,000	7.7	23.05	8	+	8	+	7	=	23
1,001-1,500	4.33	12.99	4	+	5	+	4	=	13
1,501-2,500	4.69	14.07	5	+	4	+	5	=	14
2,501-5,000	<u>0</u>	<u>0</u>	—		—		—		—
Actual Words	<u>80.0</u>	<u>240.0</u>	<u>80</u>	+	<u>80</u>	+	<u>80</u>	=	<u>240</u>
Brief Forms	35.78	107.34	36	+	36	+	35	=	107
Brief Form Derivatives	2.53	7.59	3	+	3	+	2	=	8
Syllabic Intensity	1.5	1.5	1.5		1.5		1.5		1.5
Number of Different Words	143-155								143

TABLE XV

COMPOSITION ANALYSIS OF AVERAGE DIFFICULTY LEVEL STUDY TEST

Version One

Factors	Goal		Actual						
	1 Min.	3. Min.	Min. 1	+	Min. 2	+	Min. 3	=	3 Min.
Word Groups:									
1-100	42.74	128.23	43	+	42	+	43	=	128
101-500	14.8	44.4	15	+	15	+	15	=	45
501-1,000	6.98	20.95	7	+	7	+	7	=	21
1,001-1,500	3.94	11.81	4	+	4	+	4	=	12
1,501-2,500	4.33	12.98	4	+	5	+	4	=	13
2,501-5,000	4.28	12.86	4	+	4	+	4	=	12
Over 5,000	<u>2.92</u>	<u>8.76</u>	<u>3</u>	+	<u>3</u>	+	<u>3</u>	=	<u>9</u>
Actual Words	<u>80.0</u>	<u>240.0</u>	<u>80</u>	+	<u>80</u>	+	<u>80</u>	=	<u>240</u>
Brief Forms	35.78	107.34	36	+	36	+	35	=	107
Brief Form Derivatives	2.53	7.59	2	+	3	+	3	=	8
Syllabic Intensity	1.5	1.5	1.5		1.5		1.5		1.5
Number of Different Words	143-155								149

TABLE XVI
 COMPOSITION ANALYSIS OF AVERAGE DIFFICULTY LEVEL STUDY TEST
 Version Two

Factors	Goal		Actual						
	1 Min.	3. Min.	Min. 1	+	Min. 2	+	Min. 3	=	3 Min.
Word Groups:									
1-100	42.74	128.23	43	+	43	+	43	=	129
101-500	14.8	44.4	15	+	15	+	14	=	44
501-1,000	6.98	20.95	7	+	7	+	7	=	21
1,001-1,500	3.94	11.81	4	+	4	+	4	=	12
1,501-2,500	4.33	12.98	4	+	4	+	5	=	13
2,501-5,000	4.28	12.86	4	+	4	+	5	=	13
Over 5,000	<u>2.92</u>	<u>8.76</u>	<u>3</u>	+	<u>3</u>	+	<u>2</u>	=	<u>8</u>
Actual Words	<u>80.0</u>	<u>240.0</u>	<u>80</u>	+	<u>80</u>	+	<u>80</u>	=	<u>240</u>
Brief Forms	35.78	107.34	36	+	35	+	36	=	107
Brief Form Derivatives	2.53	7.59	2	+	3	+	3	=	8
Syllabic Intensity	1.5	1.5	1.5		1.5		1.5		1.5
Number of Different Words	143-155								144

TABLE XVII
 COMPOSITION ANALYSIS OF HARD DIFFICULTY LEVEL STUDY TEST
 Version One

Factors	Goal		Actual				
	1 Min.	3. Min.	Min. 1	+ Min. 2	+ Min. 3	=	3 Min.
Word Groups:							
1-100	38.47	115.41	38	+	39	+	38 = 115
101-500	13.32	39.96	13	+	13	+	14 = 40
501-1,000	6.29	18.86	6	+	6	+	7 = 19
1,001-1,500	3.54	10.63	4	+	4	+	3 = 11
1,501-2,500	3.90	11.26	4	+	4	+	3 = 11
2,501-5,000	3.86	11.58	4	+	4	+	4 = 12
Over 5,000	<u>10.63</u>	<u>31.88</u>	<u>11</u>	+	<u>10</u>	+	<u>11</u> = <u>32</u>
Actual Words	<u>80.0</u>	<u>240.0</u>	<u>80</u>	+	<u>80</u>	+	<u>80</u> = <u>240</u>
Brief Forms	35.78	107.34	36	+	36	+	35 = 107
Brief Form Derivatives	2.53	7.59	2	+	3	+	3 = 8
Syllabic Intensity	1.5	1.5	1.5		1.5		1.5
Number of Different Words	143-155						155

TABLE XVIII
 COMPOSITION ANALYSIS OF HARD DIFFICULTY LEVEL STUDY TEST
 Version Two

Factors	Goal		Actual						
	1 Min.	3. Min.	Min. 1	+	Min. 2	+	Min. 3	=	3 Min.
Word Groups:									
1-100	38.47	115.41	38	+	38	+	39	=	115
101-500	13.32	39.96	13	+	13	+	14	=	40
501-1,000	6.29	18.86	6	+	6	+	7	=	19
1,001-1,500	3.54	10.63	4	+	4	+	3	=	11
1,501-2,500	3.90	11.26	4	+	4	+	3	=	11
2,501-5,000	3.86	11.58	4	+	4	+	4	=	12
Over 5,000	<u>10.63</u>	<u>31.88</u>	<u>11</u>	+	<u>11</u>	+	<u>10</u>	=	<u>32</u>
Actual Words	<u>80.0</u>	<u>240.0</u>	<u>80</u>	+	<u>80</u>	+	<u>80</u>	=	<u>240</u>
Brief Forms	35.78	107.34	36	+	35	+	36	=	107
Brief Form Derivatives	2.53	7.59	3	+	2	+	3	=	8
Syllabic Intensity	1.5	1.5	1.5		1.5		1.5		1.5
Number of Different Words	143-155								155

APPENDIX D

GUIDELINES FOR ADMINISTRATION OF THE
TEST INSTRUMENTS

G U I D E L I N E S

The following guidelines should be followed when administering the tests for this study:

1. Normal classroom atmosphere should be maintained as closely as possible. Responses to questions about the tests should be very general. Students should not know the design or purpose of the study.
2. Materials should not be previewed, and students should not be permitted to practice the testing materials in any way.
3. Students are instructed on the tapes to use one-inch margins and double spacing for the transcript. They are also told to put the following information in the upper right-hand corner of their paper: name, school, current date, and the code for the particular test they are taking. The above information is for purposes of recordkeeping and accuracy in collecting scores. No students will be specifically identified by name or other means in the results of the study.
4. Each of the two preliminary test tapes contain instructions to the students, a brief warmup, and two 3-minute dictation takes. Takes on one preliminary tape are at 80 words per minute, and the other tape contains two takes at 100 words per minute. Each of the six controlled study test tapes contain instructions to the students, a brief warmup, and one 3-minute dictation take at 80 words per minute.
5. The purpose of the preliminary tests is to establish recording skill levels and to show that students are approximately equal in ability.
6. Students should record and attempt to transcribe both of the preliminary takes at 80 words per minute on the first day of testing. They should follow the same procedures for both of the 100 takes on the second day. They are instructed on the tapes to transcribe the better of the two first and then spend the rest of the available time working on the other take.
7. The six controlled takes should be given during the two weeks following the preliminary tests in the order indicated at the rate of three takes per week. They should be given on consecutive days if possible.
8. Only shorthand errors will be counted for this study. This includes words omitted, inserted, substituted, mistranscribed, or otherwise varied from the verbatim dictation. Punctuation, capitalization, typographical, spelling, and other grammatical errors will not be counted.
9. Encourage students to transcribe every word possible even though the take may not receive a passing score. They should not leave

before the class period is over. All papers will be evaluated on total words. Every correct word transcribed is helpful.

10. In order to promote maximum effort, students should feel that the tests will be graded and will count for grading purposes.
11. The transcription need not be timed, and students may correct errors if they wish. However, the transcription should be completed during the same class period in which the notes are recorded.
12. Because only transcripts for students who have taken all ten tests can be used, make-up tests may be administered during the same week.
13. Students' shorthand notes should be collected and stapled to the back of the transcript at the end of each testing session.
14. All transcripts will be hand scored by researcher.

APPENDIX E

TRANSCRIPT OF INTRODUCTORY MATERIAL ON
THE PRELIMINARY TEST TAPES

TRANSCRIPT OF INTRODUCTORY MATERIAL ON
THE PRELIMINARY TEST TAPES

This is a shorthand dictation tape at (80 or 100) words per minute for three minutes. Make a note of the following four items which should be typed in the upper right-hand corner of your transcription paper.

1. Your name
2. Your school
3. Today's date
4. The code P-(80 or 100)

To review, that's your name, your school, today's date, and the code P-(80 or 100).

Please use a one-inch margin with double spacing for your transcript.

You will now be given a brief warmup and then two takes at (80 or 100) words per minute. Record as much of the dictation as you can. You should continue writing even though you may feel you have missed so much you cannot pass. Transcribe the take on which you feel you did best first and then transcribe as much as you can of the other one in the time you have left.

It is important that you transcribe every word that you can. The more you can transcribe, the higher your score will be. Remember, you should record and transcribe everything you possibly can regardless of whether your paper is passing or not.

Make sure that you are comfortable and relaxed. Here is the warmup.

(One-minute warmup at 100 words a minute) (Pause)

Prepare for the first three-minute take. (Pause) Ready.

(First three-minute take at (80 or 100) words per minute)

(Pause)

Prepare for the second three-minute take at (80 or 100) words per minute. (Pause) Ready.

(Second three-minute take at (80 or 100) words per minute)

APPENDIX F

FORM USED TO RECORD RAW TRANSCRIPTION

ERROR SCORES

RAW TRANSCRIPTION ERROR SCORES

Student Number	Name	Group Number	P-80 ₁	P-80 ₂	P-100 ₁	P-100 ₂	E ₁	E ₂	A ₁	A ₂	H ₁	H ₂

APPENDIX G

SUMMARY OF RAW TRANSCRIPTION ERROR SCORES
FOR ALL STUDENTS ON SIX STUDY TESTS

TABLE XIX
 SUMMARY OF RAW TRANSCRIPTION ERROR SCORES
 FOR ALL SUBJECTS ON SIX STUDY TESTS

Student Number	Group	Easy		Average		Hard	
		Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1	1	1	2	4	0	9	15
2	2	7	6	16	20	17	29
3	3	4	29	22	41	35	66
4	4	23	14	45	72	115	111
5	5	9	12	8	13	18	37
6	6	19	5	11	40	8	45
7	1	16	1	11	10	14	41
8	2	1	0	5	2	6	6
9	3	3	0	6	10	16	17
10	4	22	13	69	30	101	100
11	5	0	1	3	6	24	35
12	6	22	17	28	53	37	95
13	1	0	1	7	5	13	15
14	2	13	2	20	30	33	52
15	3	21	28	31	58	52	57
16	4	12	5	40	39	73	51
17	5	12	7	27	39	88	90
18	6	2	3	13	10	7	27
19	1	5	9	10	9	34	47
20	2	14	3	24	30	30	36
21	3	33	8	28	39	50	69
22	4	7	0	2	2	34	24
23	5	10	22	30	36	81	86
24	6	38	22	61	60	81	84
25	1	28	38	46	65	76	69
26	2	26	2	11	38	24	60
27	3	9	20	14	18	45	41
28	4	23	10	45	65	89	90
29	5	4	7	11	15	34	51
30	6	3	0	2	0	6	2
31	1	23	15	40	33	52	48
32	2	4	0	9	1	12	18
33	3	13	40	27	72	69	99
34	4	4	1	7	8	11	28
35	5	6	2	3	10	8	28
36	6	40	36	44	60	68	88
37	1	55	36	37	87	81	62
38	2	25	24	36	27	37	29
39	3	25	2	38	14	57	63
40	4	68	27	81	82	111	128

TABLE XIX (Continued)

Student Number	Group	Easy		Average		Hard	
		Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
41	5	30	44	82	92	111	94
42	6	27	10	9	23	17	64
43	1	22	18	45	39	59	86
44	2	61	45	60	63	69	66
45	3	24	15	35	30	60	54
46	4	1	0	1	1	4	12
47	5	36	37	43	84	71	95
48	6	2	3	8	15	6	24
49	1	70	33	69	75	107	84
50	2	76	55	58	78	61	81
51	3	29	3	42	41	57	63
52	4	31	13	43	57	78	93
53	5	46	25	50	72	53	60
54	6	12	31	43	48	48	39
55	1	24	7	16	36	63	53
56	2	83	26	61	73	83	91
57	3	6	3	1	14	15	33
58	4	24	12	45	42	68	87
59	5	24	7	44	44	54	58
60	6	36	28	33	30	59	60
61	1	10	1	13	3	20	69
62	2	25	8	30	22	50	54
63	3	45	40	49	43	50	68
64	4	54	8	56	85	62	79
65	5	74	52	76	55	76	117
66	6	85	77	102	114	116	113
67	1	16	10	11	44	45	56
68	2	58	41	101	68	115	89
69	3	56	46	62	94	100	106
70	4	56	42	33	84	73	93
71	5	27	16	36	54	79	102
72	6	42	41	62	65	70	84
73	1	15	17	21	20	28	32
74	2	25	7	42	37	68	65
75	3	66	61	81	92	107	116
76	4	22	24	50	55	77	102
77	5	2	1	4	4	6	5
78	6	46	28	55	62	93	84
79	1	64	34	50	26	73	67
80	2	54	29	94	47	68	74
81	3	13	10	18	31	50	50
82	4	78	27	92	74	173	123
83	5	41	35	48	91	82	82
84	6	4	8	30	55	77	60

TABLE XIX (Continued)

Student Number	Group	Easy		Average		Hard	
		Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
85	1	52	14	39	62	81	84
86	2	5	13	10	11	15	19
87	3	29	3	5	16	38	34
88	4	19	30	26	46	69	75
89	5	51	30	68	57	78	90
90	6	26	28	57	55	71	65
91	1	46	29	58	62	69	65
92	2	29	23	45	45	65	67
93	3	6	4	15	34	37	39
94	4	35	16	73	90	79	55
95	5	41	37	49	68	48	61
96	6	62	29	75	117	85	98

VITA

James L. Walden

Candidate for the Degree of

Doctor of Education

Thesis: A STUDY TO DETERMINE THE EFFECT OF WORD FREQUENCY ON COPY
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