THE EFFECTS OF INTELLIGENCE AND TYPES OF DRILL MATERIALS ON ACHIEVEMENT IN INTERMEDIATE COLLEGIATE TYPEWRITING

THESIS FOR THE DEGREE OF PH.D.
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This is to certify that the

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presented by

Carrie McDonald Prater

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ABSTRACT

THE EFFECTS OF INTELLIGENCE AND TYPES OF DRILL MATERIALS ON ACHIEVEMENT IN INTERMEDIATE COLLEGIATE TYPEWRITING

By

Carrie McDonald Prater

The problem of this study was to attempt to determine the effects of levels of intelligence and types of drill materials on achievement in intermediate collegiate typewriting. Achievement was measured in terms of straight-copy speed and accuracy on three-minute timed writings and in terms of production-copy speed and accuracy on 30-minute typewriting tasks.

The purpose of this study was to attempt to determine whether typewriting instructors should be concerned about the levels of intelligence of students who enroll in typewriting classes and the types of drill practice given as it relates to the organization and presentation of units of instruction.

The subjects who participated in the study were 95 students who were enrolled in five intact classes in intermediate collegiate typewriting. The results of an administration of the Otis Quick-Scoring Mental Ability Test were used as a means of grouping students into upper-ability and lower-ability categories. A typewriting pre-test was administered prior to the initiation of the study in order to determine the typewriting proficiency of the students. Upon the termination of the study, a post-test was administered in order to generate data with which to compare the pre-test results to obtain a measure of the effects

of exposure to the four experimental treatments. The two-way analysis of variance technique was used to determine whether significant differences existed between mean achievement levels on straight-copy speed and accuracy and on production-copy speed and accuracy for the four treatment groups. When instances of differences occurred which were significant, the Scheffe' post hoc procedure was used to ascertain which pair of means contributed to or was responsible for the rejection of the null hypothesis.

Approximately one-fourth of the students from each class at each of the participating universities were randomly assigned to one of the four treatment groups. Group I typed from computerized drill books. Group II typed paragraphs from magazines, Group III typed preparatory drills from the textbooks which were currently being used at their respective universities, and Group IV did not type warm-up drills.

Fifteen minutes of each class period were devoted to the experimental drill practice and one, three-minute timed writing. Each treatment group, with the exception of Group IV, typed and quickly scored a three-minute timed writing at the beginning of each class period; and the remainder of the 15 minutes was devoted to additional drill practice. After the 15 minutes of drill practice had been completed, the remainder of the class period was conducted according to the discretion of the typewriting instructors.

The two-way analysis of variance test indicated that there was a significant difference in straight-copy speed achievement among the types of drill materials used in favor of Group IV (no drills) at the .05 level of confidence. The test also indicated that there was a significant difference in production-copy speed achievement between levels of intelligence

in favor of the lower-ability students at the .05 level of confidence. No significance in achievement was indicated between groups subdivided by levels of intelligence and types of drill materials on straight-copy accuracy and production-copy accuracy.

The conclusions derived from an analysis of the findings were as follows:

1. Drill practice during the second semester of intermediate collegiate typewriting is of little value in producing meaningful gains in straight-copy speed and accuracy and in producing meaningful gains in production-copy speed and accuracy. In addition, the benefits which can be derived from emphasizing the typing of drills at the intermediate level of instruction are more in favor of the lower-ability students than the upper-ability students.

2. Levels of intelligence, as categorized in this study, do not play an important role in achievement in intermediate collegiate typewriting. However, since all treatment groups acquired mean gains in straight-copy speed and accuracy and production-copy speed and accuracy, the amount of time in which a student engages in typewriting practice facilitates achievement.

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By

Carrie McDonald Prater

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DEDICATION

This research project is dedicated to my husband, Mr. Fred Prater, and to my mother, Mrs. Liddie Ruth McDonald, without whose support this study would not have been possible; and to the memories of my father, Mr. Tommie McDonald, and my paternal grandmother, Mrs. Lucinda Taylor.

ACKNOWLEDGMENTS

The writer gratefully acknowledges the assistance and patience of the guidance committee, Dr. Helen H. Green, Dr. William Mann, Dr. Robert Poland, and Dr. James Rainey, in the preparation of this dissertation.

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Special thanks is extended to Dr. Gwendolyn Norrell who aided in the selection and acquisition of an appropriate mental-ability test and to Dr. John Schweitzer who assisted in the interpretation of the statistical tests.

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CHAPTER I

BACKGROUND OF THE STUDY

Typewriting, because of its vocational and personal use, and more recently, its use as a means of improving literacy, has for many years accounted for a large proportion of the number of students enrolled in business education courses. Statistics published by the United States Department of Health, Education, and Welfare revealed that 39.7 percent of all students in grades seven through twelve enrolled in public secondary schools during the 1970-71 school year were enrolled in business courses.[1] Nolan, Hayden, and Malsbary state that there are probably more students enrolled in typewriting than in shorthand, bookkeeping, and general business combined.[2]

According to national figures releases by the United States Department of Labor, the employment outlook for those who have completed a clerical sequence is optimistic. The 1974-75 edition of the Occupational Outlook Handbook showed that during 1972, over 435,000 persons were employed as receptionists,[3] over 3,000,000 were employed as secretaries

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[1]United States Department of Health, Education, and Welfare, Digest of Educational Statistics, DHEW Publication No. (OE) 74-11103 (Washington: Government Printing Office, 1973), p. 42.

[2]C. A. Nolan, Carlos K. Hayden, and Dean R. Malsbary, Principles and Problems of Business Education, Third Edition, (Cincinnati: South-Western Publishing Company, 1967), p. 237.

[3]United States Department of Labor, Occupational Outlook Handbook, Bulletin 1785, (Washington: Government Printing Office, 1974-75 Edition), p. 96.

and stenographers,[4] and over 1,000,000 were employed as typists.[5] The Occupational Outlook Handbook further states that:

> The number of typists needed is expected to grow rapidly through the mid-1980's as business expansion increases the volume of paper work. There will be several thousand job openings each year due to the growth of the occupation and the need to replace those who stop working or transfer to other jobs.
>
> Demand should be particularly strong for highly skilled workers and those who can handle other office jobs as well as typing. Some employers will prefer typists who are familiar with new kinds of typing equipment such as high-speed machines equipped with magnetic keyboards.[6]

Currently, typewriting is also being taught on an experimental basis in many progressive elementary schools; and it appears to be increasing in popularity. At this level, the major emphasis of the course is the development of all language arts skills. That is, the typewriter is used as a writing machine rather than a copying machine.[7] Accordingly, Bober maintains that learning to typewrite is directly related to the improvement of language arts skills.[8]

Brown states that typewriting is an essential adjunct to communication and that it has become a necessity for the writer as well as the reader.[9] She further contends that the usefulness of typewriting is so

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[4] Ibid., p. 103.

[5] Ibid., p. 105.

[6] Ibid., p. 106.

[7] John L. Rowe, "Typewriting in the Seventies--An Overview," National Business Education Yearbook, No. 12, (Reston, Virginia: National Business Education Association, 1974, p. 58.

[8] Charles F. Bober, "Typewriting in the Elementary Schools," Business Education Forum, Vol. 29., No. 4, January, 1975, p. 16.

[9] Eleanor B. Brown, "Typewriting for the Gifted," Business Education Forum, Vol. 22, No. 2, November, 1967, p. 7.

universally accepted that to deny anyone the opportunity to learn the basic principles of efficient, effective typewriting is to deny them a convenient lifelong means of expression and that the student who cannot type is, indeed, handicapped.[10]

Tonne believes that the high enrollments in typewriting classes are justified. He maintains that not only has typewriting become an almost universal communications instrument but also will probably become increasingly important as electronic data processing becomes an integral element in our communications system.[11] He further maintains that the typewriter, in some form, will almost certainly continue to be the basic means of input for electronic data processing and be the key for securing specific electronic data processing output in useful form.[12] Campbell asserts that the world of automation of which Tonne speaks and which requires error-free input, is causing an increased demand for accurate typists.[13]

The fact that typewriting is taught on all educational levels and that the need for typewriting skills is so great necessitate constant evaluation and assessment of procedures which can be used in the typewriting classroom so that students will reach their optimum potentials within the limited amount of time allotted to the achievement of the objectives of the course. Having such large, heterogeneous numbers of

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[10] Ibid.

[11] Herbert A. Tonne, "Ubiquitous Typing," Journal of Business Education, Vol. XLVI, January, 1971, p. 140.

[12] Ibid.

[13] Don Campbell, "Let's Take A Look At Typewriting Accuracy. . .", Journal of Business Education, Vol. XLV, No. 2, November, 1969, p. 55.

students also brings into sharp focus the importance of developing, testing, and perfecting new methods and materials in typewriting in order to plan and implement efficient programs of individualized instruction.

I. THE PROBLEM

Statement of the problem. The problem of this study was to attempt to determine the effects of levels of intelligence and types of drill materials on achievement in intermediate collegiate typewriting. Achievement was measured in terms of straight-copy speed and accuracy on three-minute timed writings and performance on production typewriting tasks as measured by speed and accuracy on production copy timed for 30 minutes.

Purpose of the study. The purpose of this study was to attempt to determine whether typewriting instructors should be concerned about the levels of intelligence of students who enroll in typewriting classes and the types of drill practice given as it relates to organization and presentation of units of instruction.

If levels of intelligence and types of drill practice do, in fact, influence achievement of speed and/or accuracy on straight-copy timed writings and/or satisfactory performance on production typewriting tasks, then it would be beneficial for the typewriting instructor to have some knowledge of the range of each student's capabilities as well as the type of drill practice which is likely to influence achievement. This knowledge could serve as a basis for the determination of the areas of emphasis in the teaching of typewriting and for the more efficient individualization of learning activities which will contribute to the optimum development

of those skills and knowledges needed to perform competently upon the completion of the typewriting course.

If, on the other hand, levels of intelligence and types of drill materials do not affect performance on either straight-copy timed writings or production typewriting tasks, the typewriting instructor would have some rationale for gearing teaching activities toward other areas which might facilitate achievement in intermediate collegiate typewriting.

Importance of the study. This study was important because it involved the use of two types of drill materials which have not been utilized heretofore in scholarly research. One type of drill material which fits this category was a computerized drill book which was composed of copy material specifically designed to analyze the student's typewriting errors. This drill book was based largely upon a research study conducted by David H. Weaver (see Chapter II).[14] Weaver found "that no random practice can be assigned as having uniform import upon a large group of students." Furthermore, Weaver's results demonstrated that the difficulty or ease with which the subjects typed the weighted copy reflected their speed levels, the kind of machine they were using, and the ratio of the various stroking patterns located in the material. In addition, he found that it was not possible to prescribe each type of factor as being consistent for all speed levels or for all machines and that there is a difference between the effects that some factors have upon speed and their effects upon accuracy.[15]

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[14]University Microfilms, Dissertation Abstracts, Vol. 27, No. 10, (Ann Arbor, Michigan, 1967), p. 355.

[15]Ibid.

In the drill book (which utilized the results of the Weaver study) the student, depending upon the number of errors made on the first timed writing, is directed by instructions contained in the book to type a remedial drill which is geared either toward developing greater speed or greater accuracy. The title of the drill book is Selective Practice Typing Drills and was published in 1974.

The second type of drill material consisted of ordinary English prose, such as is to be found in magazines or books. In this instance, magazines were selected. The use of ordinary English prose for both speed and accuracy practice has been advocated by a well-known researcher, Leonard J. West. According to West, materials and procedures for building ordinary copying skills must be based on five demonstrable facts. One of these is that, with few exceptions, materials for both speed and accuracy practice should be ordinary English prose.[16] West believes that there is no merit in specially contrived drills. He feels that much of the specially contrived materials or "special focus materials" are useless.[17] West states that:

> The reason for the failure of contrived materials of the sort mentioned (nonsense sequence, easy words, hard words, common words, uncommon words, balanced-movement words, first-finger words, and third-finger words) to be beneficial lies in a concept that is fundamental to all learning, one with which the reader should by now be familiar, namely, transfer. To illustrate: Practice at some particular balanced-movement word (one involving a left-right alternation of the hands, e.g., their) will make you better at that word and no other words in the language whatever except those that contain the same letter sequences. Practice at one-finger words like cede does not strengthen that finger in general; it merely contributes to

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[16]Leonard J. West, Acquisition of Typewriting Skills, (New York: Pitman Publishing Corporation, 1969), p. 235.

[17]Ibid., p. 239.

> facility at that word and at other words containing the same letters or letter sequences. Practice at some thing makes one better at that thing, not at other things. In the deepest sense, there is no such thing as speed in general, facility in general, rhythm in general. Instead, one develops those things on whatever particular words have been practiced. One might suspect such materials to be mere window dressing, perhaps created out of a need to feel that there is something complicated or recondite about the practice materials. Instead, with exceptions, the answer is simplicity itself: ordinary English.[18]

II. HYPOTHESES

The hypotheses tested in this study, which were restated for statistical analysis in null form, were as follows:

1. Speed in intermediate collegiate typewriting on straight-copy material will be affected by types of drill materials used.

2. Speed in intermediate collegiate typewriting on straight-copy material will be affected by levels of intelligence.

3. Speed in intermediate collegiate typewriting on straight-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

4. Speed in intermediate collegiate typewriting on production-copy material will be affected by types of drill materials used.

5. Speed in intermediate collegiate typewriting on production-copy material will be affected by levels of intelligence.

6. Speed in intermediate collegiate typewriting on production-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

7. Accuracy in intermediate collegiate typewriting on straight-copy material will be affected by types of drill materials used.

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[18] Ibid., p. 240.

8. Accuracy in intermediate collegiate typewriting on straight-copy material will be affected by levels of intelligence.

9. Accuracy in intermediate collegiate typewriting on straight-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

10. Accuracy in intermediate collegiate typewriting on production-copy material will be affected by types of drill materials used.

11. Accuracy in intermediate collegiate typewriting on production-copy material will be affected by levels of intelligence.

12. Accuracy in intermediate collegiate typewriting on production-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

In addition, 24 subhypotheses were postulated concerning the possible interactions between each type of drill material and each level of intelligence regarding straight-copy speed, straight-copy accuracy, production-copy speed, and production-copy accuracy. For example:

1. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment I (computerized drills).

2. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment II (magazine drills). (See Appendix A for the entire list of the 24 subhypotheses.)

III. ASSUMPTIONS

The following assumptions underlie the research effort:

1. The time of day in which classes were conducted would not adversely affect the students' performances.

2. Instructors would be amenable to the use of the four types of drill materials in their typewriting classes.

3. Students would be amenable to the use of the types of drill material to which they would be assigned for the duration of the study.

4. Practice time spent in the typewriting laboratory after regular class hours by either treatment group would not significantly affect mean gains in speed and accuracy on straight-copy timed writings or production copy.

5. The use of different textbooks by the participating classes would not result in significant differences in the terminal performances of the four treatment groups on straight-copy speed and accuracy or production-copy speed and accuracy.

IV. DELIMITATIONS

The problem of this study was limited to the effects of four types of drill materials only and their influence on the achievement levels of students classified as possessing upper intellectual abilities and students classified as possessing lower intellectual abilities as measured by the results of an administration of the Otis Quick-Scoring Mental Ability Test.

It is generally recognized that many factors affect and contribute to the success of learning the skill of typewriting such as age, sex,

visual acuity, finger dexterity, reading ability, vocabulary, English competency, and grade point average. However, these variables were not included as separate factors so as not to confound the findings of the study.

In addition, this study was not concerned with the teaching abilities of the instructors involved or the interpersonal relationships between the students and the instructors which might have some psychological bearing on the achievement of the students.

This study did not attempt to analyze the fatigue factor, classroom settings, or the time of day students should enroll in the typewriting class as determinants of achievement in intermediate collegiate typewriting.

Further, the effects of previous instruction in typewriting, whether in high school or through repeating the course on the collegiate level, were not taken into consideration in this study.

V. LIMITATIONS

As the subjects included in this study were not random samples but were students already enrolled in intermediate collegiate typewriting classes, the generalizability of the findings will necessarily be limited to typewriting classes in similar geographic locations, in similar four-year colleges, and students of similar intellectual abilities.

The investigator had no means of determining whether students performed to the best of their abilities on the Otis Quick-Scoring Mental Ability Test; therefore, there might have been error in categorizing students as upper ability and lower ability.

No features were built into the study to control the syllabic intensity, selection of paragraphs, size of print, or layout of the pages of the magazines which were used by students assigned to Treatment II. However, various issues of the same magazine were used by the Treatment II group.

VI. DEFINITIONS OF TERMS USED

Achievement. The typewriting speed and accuracy of all treatment groups as measured by performance on three-minute timed writings on straight-copy material and speed and accuracy on production typewriting tasks timed for 30 minutes.

Computerized drill book. A typewriting drill book composed of copy specifically designed to analyze students' typewriting errors. Depending upon the number of errors made on their first three-minute timed writing, the students are directed by instructions contained in the book to type a remedial drill which is geared either toward developing greater speed or greater accuracy. The book is entitled Selective Practice Typing Drills, was coauthored by Alan C. Lloyd, Robert P. Poland, John L. Rowe, Fred E. Winger, and William D. Griffith, and was published in 1974.

Lower-ability student.* A student whose mental ability is determined to be 90 and below by the results of an administration of the Otis Quick-Scoring Mental Ability Test.

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*In order to divide the two groups of students as evenly as possible, it was necessary to slightly overlap the two categories; thus, the two groups were not mutually exclusive. Three students with mental abilities of 90 were assigned to the upper-ability group, and all other students with mental abilities of 90 and below were assigned to the lower-ability group.

Upper-ability student. A student whose mental ability is determined to be above 90 by the results of an administration of the Otis Quick-Scoring Mental Ability Test.

Production copy. Office-type typewriting tasks such as letters, memoranda, manuscripts, tabulations, minutes of meetings, and news releases.

Straight-copy material. Copy consisting of commonly used words which does not contain Arabic or Roman numerals.

VII. ORGANIZATION OF THE STUDY

The organization of this study is as follows:

Chapter I: Background of the Study

Chapter II: Review of the Related Literature

Chapter III: Methods and Procedures

Chapter IV: Analysis of the Data

Chapter V: Summary, Conclusions, Implications, and Recommendations

CHAPTER II

REVIEW OF THE RELATED LITERATURE

Much has been written with regard to the testing and development of more efficient types of copy materials to be used in the building of speed, accuracy, and production skills in typewriting. Research findings to date have yielded inconclusive results. This absence of established, definitive procedures is evidenced by the numbers of studies which are undertaken each year in an effort to determine those techniques which will produce the most competent typists. The review of literature of this study, however, is limited to a small, representative sample of investigations which are specifically related to the utilization of various types of drill materials to enhance achievement in typewriting.

The Weaver Study. The computerized drill books which were used in the current study were developed as a result of the findings of the Weaver study. Weaver's experiment was conducted to investigate the impact that various alphabet and punctuation stroking sequences existing in straight-copy materials have upon a learner of typewriting as he or she progresses through various speed levels on an electric or manual typewriter.[1] Weaver measured the impact on two variables: gross words per minute typewritten (rates) and number of error incidents in three minutes (accuracy).

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[1]Dissertation Abstracts, Vol. 27, No. 10, (Ann Arbor, Michigan: University Microfilms, 1967), p. 355.

Weaver used a total of 540 subjects in the experiment. The students were randomly selected from 75 classes in 11 urban, suburban, and rural public and parochial high schools which required daily classroom typewriting.

The three-minute timed writings were administered by the instructors in the same manner as other regularly timed materials. The subjects were divided according to manual and electric typists and into five speed groups according to their initial speeds. The 54 experimental timed writings were prepared in which the percentage of strokes for each factor was controlled. A different timed writing was prepared for grouping the students according to their normal typewriting rates. Each subject was required to take only one experimental timed writing.

Among Weaver's significant findings were:

1. Electric machines increased rates over manual machines at the .05 level of confidence.

2. Significant differences existed between right handedness on electric machines versus left handedness on manual machines and double-letter strokes on electric machines versus consecutive-finger strokes on manual machines at the .05 level of confidence.

3. Double-letter strokes on accuracy on manual machines significantly decreased the incidents of error over consecutive-finger strokes on electric machines at the .05 level of confidence.

As was pointed out in Chapter I, the Weaver experiment revealed that no random practice material can be assigned as having uniform impact upon a large group of students. Weaver's results demonstrated that the difficulty or ease with which the subjects typed the weighted copy was a reflection of their speed levels, the kinds of machines used, and also

the ratio of the various stroking patterns located in the material. His results also revealed that it was not possible to prescribe each type of factor as being consistent for all speed levels or for all machines and that there is a difference between the effects that some have upon speed and their effects upon accuracy. The percentage of total key strokes attributed to each factor was determined by its content proportions in six commonly used typewriting textbooks. The experimental percentage range for each factor was weighted in proportion to the percentage of strokes allocated to that factor. The constants were: word frequency, syllabic intensity, and stroke intensity.

The results of the Weaver study revealed that the rate components which were significant at the .05 level of confidence were:

1. Strokes, with double-letter strokes increasing rates but consecutive-finger strokes decreasing rates.

2. The interactions of double-letter strokes with right handedness or with left handedness which increased rates significantly over left handedness by consecutive-finger strokes.

The accuracy component significant at the .01 level was again strokes, with double-letter strokes decreasing the incident of error and consecutive-finger strokes increasing the incident of error. The interaction of double-letter strokes by proximate motions decreased errors over consecutive-finger strokes by out motions at the .05 level of confidence.

The Byford Study. The purpose of the Byford study was to determine whether typewriting drills containing language arts concepts would significantly improve language arts knowledges and typewriting speed and accuracy

in second semester high school typewriting.[2] The intentional approach was used in the presentation of the language arts concepts.

Byford utilized a total of 45 language arts drills which were written specifically for his investigation. The drills were divided into three parts: presentation of formal language arts concepts, presentation of an example illustrating the concept, and provision of space for students to compose their own examples using the formal language arts concept. The language arts areas included in the drills were grammar, mechanics, punctuation, spelling, and diction. The drills were incorporated as a part of the daily warmup activities at the beginning of each typewriting class period. A single concept was presented each day for 45 consecutive days.

The subjects of Byford's study were eight intact second-semester typewriting classes at the Robert E. Lee High School in Baytown, Texas. Four of the eight classes were randomly assigned to the control group which consisted of 120 students, and the remaining four classes comprised the experimental group which also consisted of 120 students. The experimental group typed specially prepared drills containing language arts concepts for the first ten minutes of each class period. The control group typed traditional warmup drills from the textbook for the first ten minutes of each class period.

Prior to the initiation of the study at the beginning of the second semester, the experimental groups and the control groups were administered a pre-test which included Form 2A of the Cooperative English Test and a three-minute straight-copy timed writing. For nine weeks immediately

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[2]David Lent Byford. An Investigation of Language-Drill Effectiveness in Second-Semester Typewriting on the Secondary Level, Unpublished Doctoral Dissertation, University of Houston, 1971.

following the pre-test, the experimental group typed daily drills pertaining to the linguistic concepts. At the end of the nine-week drill period, a post-test which consisted of Form 2B of the Cooperative English Test and a three-minute straight-copy timed writing were administered to all subjects participating in the study. For retention study purposes, Form 2C of the Cooperative English Test was administered as a follow-up test six weeks after the beginning of the drill period. A three-minute straight-copy timed writing was also given six weeks after the drill period to compare speed and accuracy improvement.

Two hypotheses were formulated to determine if a significant difference existed in achievement and retention of language arts concepts between the experimental groups and the control groups and if a significant difference existed in three-minute straight-copy timed writings between the experimental groups and the control groups. The analysis of variance statistical method was used to analyze the data generated by the study.

Byford found the following to be significant as a result of the statistical tests:

1. Experimental students using the specially prepared language arts drills scored significantly higher on the post-test and follow-up test than did the control group.

2. A significant difference in language arts ability was apparent between the experimental groups and the control groups according to post-test scores and was significant at the .02 level of confidence.

3. The experimental group scored significantly higher on the language arts follow-up test than did the control group.

4. A significant difference existed in language arts concepts between the pre-test and post-test performance of the experimental groups.

5. The experimental groups acquired a significant gain at the .001 level of confidence in language arts concepts knowledge from the pre-test period to the follow-up test period. This gain was attributed to the specially prepared drills completed by the experimental groups.

6. During the study, consistent typewriting speed and accuracy improvement was made by the subjects of both groups.

After an analysis of the findings, Byford reached the following conclusions:

1. Students can learn and retain a significant amount of language arts subject matter as a result of using intentional drills in the typewriting class. The typewriting drills for language arts development should consist of a concept, an illustrative concept example, and student application of the concept.

2. The experimental groups learned the language arts concepts as a function of practice on the drills. The specially prepared linguistic drills proved to be an effective method of presentation for achieving gains in language arts ability.

3. The language arts typewriting drills did not appear to be beneficial to the students' speed and accuracy improvement, nor did the drills adversely affect their speed and accuracy improvement.

The Crawford Study. The purpose of the Crawford study was to determine the effects of emphasizing production typewriting contrasted with speed typewriting in developing production typewriting skills on the

collegiate level.[3] During the course of the experiment, Crawford sought to answer questions involving the following six related areas: (1) comparisons of group performance for classes taught by contrasted methods, (2) comparisons of performance for individuals matched on selected factors and taught by contrasted methods, (3) comparisons of production-performance rates with net stroking and net performance rates, (4) comparisons in production performance of subjects in the upper and lower distribution limits, (5) comparisons of gains in selected related areas for classes taught by contrasted methods, and (6) relationships between production-rate gains and selected related factors. In order to discover answers to the preceding questions, Crawford employed two contrasting methods of teaching which he identified as the traditional, speed-emphasis method, and the experimental production-emphasis method. The formal period of research for the study covered one year.

Students who participated in the study were students who were enrolled in intermediate typewriting at Indiana University during the 1954-55 academic year. In each of the two semesters covered by the study, students were divided into one control-group class and three experimental-group classes. During the first semester, 37 students comprised the control group and 85 students comprised the experimental group. During the second semester, 22 students were assigned to the control-group class, and 82 students were assigned to the experimental-group class.

Classes met for four days each week for a total of 50 minutes each day. Outside practice and additional instruction, other than that which

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[3]Thomas James Crawford. The Effects of Emphasizing Production Typewriting Contrasted With Speed Typewriting in Developing Production Typewriting Ability, Unpublished Doctoral Dissertation, University of Pittsburgh, 1956.

was provided during the regular class period, was not permitted for the duration of the study. Crawford took this precaution in order to insure that the results of the tests would reflect only the performance acquired during the formal classroom sessions.

At the beginning of each semester, a battery of four tests was administered to all the subjects to determine their initial status in production ability, net stroking speed, and related information. At the end of each semester, the same tests were readministered to ascertain the students' terminal status in the same four areas. Comparisons were drawn between the two sets of scores in order to learn the extent of gains achieved on each test throughout the semester. Once during each semester, an arithmetic test consisting of 48 questions covering the fundamental processes was given to the students to determine their general arithmetic abilities. In addition to the performance-test data assembled for each student, scores indicating their levels of general intelligence and their levels of reading comprehension were compiled from records made available via the Indiana University Bureau of Measurement.

The control groups and the experimental groups were equated on six different factors which were: initial production ability, initial net stroking rate, initial performance rate, initial related information scores, general intelligence, and reading comprehension.

The outcomes of the Crawford study can be summarized as follows:

1. The production-emphasis method (experimental) produced significantly greater production ability than did the speed-emphasis method (control) for the contrasted groups as well as for the matched individuals.

2. The levels of performance in production typewriting were consistently and appreciably lower than the performance in net stroking for both the control group and the experimental group.

3. The level of skill in net stroking was not necessarily indicative of the ability of a typist in production typewriting.

4. The level of skill in net stroking did not necessarily transfer to production typewriting.

5. The general trend of performance among the subjects was that those with high net stroking rates tended to gain more in production typewriting than those with low net stroking rates.

6. The nonspeed (experimental) group gained more in one semester, and almost as much in the other, in net stroking skill as the speed-emphasis (control) group.

7. The gains in net performance skills between the experimental group and the control group were not significant.

8. The experimental group greatly surpassed the control group in the acquisition of related information.

9. The relationships between production gains and selected factors proved to be inconclusive.

The Dodson Study. The purpose of the Dodson study was to determine whether the use of interesting copy material in typewriting would result in greater speed and accuracy than would the use of noninteresting copy material in the second semester of high school typewriting.[4] For the study, Dodson prepared two sets of interesting materials. Each set was

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[4]Glenna Ardath Dodson. The Effects of Interesting and Noninteresting Copy Material on Speed and Accuracy in Typewriting, Unpublished Doctoral Dissertation, University of Florida, 1959.

composed of 12 stories and each contained approximately 300 standard words. One set was designed to hold the attention of males, and the other set was intended to be absorbing for females. The categories of materials for males were mystery, adventure, patriotism, humor, and biographies of famous men. The five categories for females included mystery, adventure, sentiment, home and family life, and humor. Before the study was begun, the sets of materials were rated by 52 males and 77 females who were enrolled in first semester high school typewriting classes. The panel of judges, however, did not participate in the actual study. The assessments were made using a seven-point Likert-type scale which ranged from very interesting to very uninteresting. None of the copy material was included in the study if it received a rating lower than any of the other materials in a particular category. The textbook timed writings were rated as noninteresting by the same group of students.

The students who served as subjects for the study were randomly selected from 23 second-semester high school typewriting classes. Fifty percent of the males and 50 percent of the females in each of the participating classes were assigned to take the interesting timed writings and the other 50 percent of the males and females were assigned to take the noninteresting timed writings. No student was included in the study who was unable to complete the two timed writings within the allotted amount of time or if he or she were unable to recall the essence of the copy material when quizzed immediately following the writings. From the qualifying students, Dodson used a table of random numbers to assign 35 males and 35 females to the group to type the interesting materials, and 35 males and 35 females comprised the group to type the noninteresting materials for the duration of the study. Two timed writings taken from the

sixth edition of 20th Century Typewriting by Lessenberry and Crawford were administered to verify the base speed and accuracy for each of the participating students.

Dodson used the t-test to analyze her data in order to establish: (1) the effects on speed in typewriting performance among females when interesting and noninteresting timed writings are used, (2) the effects on speed in typewriting performance among males when interesting and noninteresting timed writings are used, (3) the effects on speed in typewriting performance among the total group of males and females when interesting timed writings are used and among the total group of males and females when noninteresting timed writings are used, (4) the effects on accuracy in typewriting performance among females when interesting and noninteresting timed writings are used, (5) the effects on accuracy among males when interesting and noninteresting timed writings are used, (6) the effects on accuracy in typewriting performance among the total group of males and females when interesting timed writings are used and among the total group of males and females when noninteresting timed writings are used, and (7) the ability of the males and females to recall the interesting timed writings and the ability of the males and females to recall the noninteresting timed writings.

From an analysis of the data, Dodson found that:

1. The females who typed the interesting materials had an average decrease in speed of 1.18 gross words per minute from the base typewriting speed, and the females who typed the noninteresting materials had an average decrease in speed of .865 gross words per minute. The difference among the females on speed performance was significant.

2. The males typing from the interesting materials experienced an average decrease in speed of .47 gross words per minute below their base speeds while the males typing from noninteresting materials experienced an average decrease in speed of 1.72 gross words per minute. This difference among the males was great enough for statistical significance.

3. The total group of students assigned to type from the interesting materials sustained a decrease of .83 gross words per minute below their base speeds while the group of students assigned to type from the non-interesting materials attained an increase of 1.29 gross words per minute. The difference in the speed of the total group was significant.

4. There was no significant difference in the amount of increase or decrease in the number of errors committed among any of the groups.

5. The difference among both the males and the females to recall the interesting and noninteresting materials was significant. The females typing from interesting materials remembered 2.77 timed writings out of ten while those females typing from noninteresting materials remembered 1.96. The males exposed to interesting materials were able to remember 2.94 timed writings out of ten while those exposed to noninteresting materials remembered only .77 timed writings out of ten.

The Gades Study. Gades undertook his study in order to ascertain the effects of short-duration high-speed drills on speed, accuracy, and production rate development in the first year of high school typewriting.[5] Gades enumerated the following as the purposes of his study: (1) to develop a high-speed drill procedure consistent with certain

[5]Robert Ellard Gades. The Effects of Short-Duration High-Speed Drills on Speed, Accuracy, and Production Development in First-Year Typewriting, Unpublished Doctoral Dissertation, North Texas State University, 1967.

psychological concepts in motor-skill learning, (2) to test the high-speed drill procedure in selected high school beginning typewriting classes for a full school year, (3) to determine the better procedure for teaching beginning typewriting by comparing the results of the high-speed procedure with the results of the standard procedure through the use of matched groups of beginning high school typewriting students, (4) to compare typewriting production work of the two groups to determine whether one procedure is superior to the other in developing production rates, and (5) to determine whether the high-speed drill procedure continues to be effective during the second semester if it proves to be effective in the first semester.

The sex ratio of the two groups was not equal but similar. The study included a total of 352 subjects with females outnumbering males by an approximate ratio of five to three. The experimental group was composed of 183 subjects—65 males and 105 females. The control group was composed of 183 subjects—65 males and 118 females.

Six teachers of beginning typewriting were involved in Gades's study. Only those who taught at least two typewriting classes were accepted for participation in the study. One class taught by each of the instructors was designated as experimental and the other was designated as the control group.

Beginning with the fourth week of school and continuing through the 34th week, the experimental group used a high-speed drill procedure for ten to twenty minutes of each class period. The high-speed drill procedure was developed in terms of established criteria, using six drills adopted from other sources and one drill developed specifically for the study. The drills were incorporated in a student drill booklet and made

available to all students in the experimental classes. Gades also developed a teacher's handbook which explained the use of the drills and provided lesson plans for the experimental portion of each class session. These drills used short passages from material designed to force the learners to type at their maximum speeds for short periods of time which did not exceed one minute in length.

The control groups used the standard speed and accuracy development procedures presented in current high school textbooks. The procedures emphasized short timed writings early in the course and gradually increased the timings to five minutes after 50 lessons. After the 50th lesson, emphasis was shifted to longer, sustained writings.

In order to obtain periodic measures of progress, Gades required the administration of typewriting speed tests to both the experimental and the control groups at the end of two-week intervals. The tests consisted of three, one-minute timed writings and two, five-minute timed writings on straight-copy material. The best one-minute and five-minute scores in errors and gross words per minute were recorded for each of the students.

Gades maintained learning curves in order to provide himself with a means of visual feedback of the groups' progress during the course of the study. The learning curves were developed from the bi-weekly one-minute and five-minute timed writings, and they revealed that the development of speed for both the experimental and the control groups followed a similar pattern. However, the learning curve representing error patterns indicated that the control group was more erratic in their performance than was the experimental group.

Gades used the t-test to analyze his data, and the findings of his study tended to support the hypothesis that the use of high-speed short-duration drills would produce higher levels of speed and accuracy in one year of typewriting than would the use of a standard procedure.

The findings also appeared to sustain the hypothesis that high-speed drills would produce significantly higher production rates at the end of the school year than would the standard textbook procedures. The experimental groups, using the high-speed drill procedure, gained significantly higher scores on a standard production test than did the control group on the same test. The production test Gades used was the United Students Typewriting Test, for which a national norm of 97 has been established. Although the experimental group scored significantly higher than the control group, both groups ranked below the national average. The average production score for the experimental group was 82.9, and the average production score for the control group was 76.8.

The Johnson Study. The Johnson study was similar to the Gades study in that both tested the effects of a high-speed drill procedure on speed and accuracy achievement in beginning high school typewriting.[6] The length of the Johnson study, however, was only one semester. In order to determine the effects of the drills, Johnson isolated the speed-building portion of each instructional period in each of the 18 high school classes for experimentation with respect to the use of the two procedures for building speed. The procedure used as a control element

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[6]James Roland Johnson. The Effects of High-Speed Drills on Speed and Accuracy Development in Beginning Typewriting, Unpublished Doctoral Dissertation, North Texas State University, 1963.

in the experiment was based on speed-building drills representative of those recommended in current typewriting textbooks prevalently used in many beginning high school typewriting classes. The experimental procedure used was based on the use of eight selected high-speed drills which Johnson believed conformed to the theoretical requirements of motor-skill development.

The speed-building procedure for the control group was based on the following steps:

1. Set a new, higher pace on two or three repeated half-minute timed drills on easy copy.
2. Maintain a new pace for a full minute, using paragraph copy. Gradually increase the time the new pace is maintained to longer periods of time--two, three, four, five, and ten minutes.
3. Have a review practice on the most difficult words after each paragraph timing.

The philosophy underlying these procedures is based on a gradual increase in the length of timed drills. A combination of both short and long timed drills was used throughout the semester; however, after the fourth week of instruction, the longer timed drills began to predominate. After the sixth week of instruction, at least one or more of the five-minute timed drills is suggested as a standard part of each lesson.

The experimental procedure stressed the taking of short, intensive, high-speed timed writings. The purpose of these drills was not to try to maintain the high speed for gradually increased periods of time, but to provide conditions favorable for the continual building of rapid associations.

The 18 typewriting classes included in the study were taught by five instructors in four high schools in the Dallas-Fort Worth, Texas,

area. The groups were matched according to the following factors:

1. Similar ratio of males to females
2. Mean mental maturity score
3. Time of day during which class was taught
4. Initial stroking ability as measured by a straight-copy test at the end of three weeks of instruction

The schools were selected at random from the independent school districts in surburban communities. The instructors were also selected at random from among the instructors in each school who taught three or more beginning typewriting classes.

The t-test was used to compare the groups with regard to mental maturity scores and initial stroking ability, and no significant difference was found among the groups on these two matching factors. The students were divided into three treatment groups. One was designated as experimental, another as control, and a third as combined. The experimental and control groups were composed of classes which met at periods one, two, and three.

To obtain a measure of progress in speed and accuracy, each class was given three, one-minute timed writings and two, five-minute timed writings once each week on the straight-copy material. The best one-minute timed writing and the best five-minute timed writing was used as the measure of achievement for each week. Other than ten to twenty minutes spent each day on the experimental and control drill procedures, all classes devoted their class time to regular textbook assignments.

Johnson again employed the t-test to analyze his data. On the final one-minute timed writing, speed performance of the experimental group was significantly greater than that of the control and the combined groups

at the .01 level of confidence. The final speed of the combined group, however, was not significantly greater than that of the control group.

The final five-minute timed writing administered at the end of the study showed that the speed attainment of the experimental group was significantly better than that of both the control group and the combined group; however, the speed attainment of the combined group was not significantly greater than that of the control group.

On the final one-minute timed writing, there was a significant difference at the .01 level of confidence between the typewriting accuracy of the experimental group and the control group. There was also a significant difference between the experimental group and the combined group at more than the .01 level of confidence. No significant difference was found between the performance of the control group and that of the combined group at the .01 level; however, there was a difference between the performance of these two groups at the .05 level of confidence. The performance of the combined group was not significantly better than that of the control group.

Johnson learned that, although supporting his hypothesis, the learning curve indicated that the use of the experimental high-speed drills did not produce the best results in all instances. The learning curve also disclosed that each of the experimental groups maintained a lower error rate on the five-minute timed writings than did any of the other classes in their sections.

The final speed and accuracy scores reported by the Johnson study were considered to be above average for beginning typists when compared with speeds suggested by several typewriting speed standard studies.

The mean speed for the experimental group was 33 words per minute, 31 words per minute for the combined group, and 30 words per minute for the control group.

The Mach Study. This study was conducted to determine if there were any significant differences in the straight-copy speed achievement and accuracy achievement of first-semester secondary school typewriting students who learn to typewrite through repetitive practice drills and those who learn to typewrite through non-repetitive practice drills.[7] This research was also undertaken to ascertain whether repetitive drills practice or non-repetitive drills practice would lead to higher skill levels between the upper third, the middle third, and the lower third of each group when ranked according to speed achievement. In addition, the study also sought to determine if the two contrasting methods of teaching would produce any significant differences between students using non-electric typewriters and those using electric typewriters.

A control group and an experimental group in beginning typewriting were randomly selected from each of four participating high schools in the Eau Claire, Wisconsin, area. The same instructor taught both the experimental and the control group, and both groups met in the same typewriting room at their respective schools.

After the keyboard had been presented, three, one-minute straight-copy timed writings were administered. From the students' scores, the mean straight-copy stroking rate for each group was computed. This data

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[7]Kaye Allan Mach. The Effects of Repetitive and Non-Repetitive Practice on Straight-copy Speed and Accuracy Achievement in First-Semester Beginning Typewriting, Unpublished Doctoral Dissertation, University of North Dakota, 1971.

appeared to suggest that there was no significant difference between the control group and the experimental group on gross stroking rates during the first class session after the presentation of the keyboard, and the actual experiment was initiated with the subsequent class meeting.

The control group typed one lesson per day which had been reproduced from Gregg Typing I, 191 Series, second edition, 1967, by Rowe, Lloyd, and Winger which was published by the Gregg Division of the McGraw-Hill Book Company. An accompanying lesson plan was provided for each lesson. The lesson plan was constructed to allocate sufficient time for all students in the control group to repeat each line in the lesson at least three consecutive times.

The students in the experimental group typed the same material as the control group but were not allowed to repeat any of the material. In order to insure that the experimental group spent the same amount of time on each activity as the control group, additional materials for the experimental group were taken from 20th Century Typewriting, ninth edition, 1967, by Lessenberry, Crawford, and Erickson which was published by South-Western Publishing Company; and Modern Typewriting Practice, third edition, 1972, by Altholz and published by the Pitman Publishing Company.

A series of three, three-minute timed writings were administered on three different occasions during the 65-day experiment. The first of the series was administered during the 22nd class meeting, the second during the 43rd class meeting, and the third during the 65th class meeting.

Mach used a separate one-way analysis of variance to test each of her 36 hypotheses. On the first three-minute straight-copy timed writing which was administered during the 22nd class meeting, Mach found that there was no significant difference between the speed and accuracy achievement of the experimental and control groups at the .05 level of confidence. She also learned that there was no significant difference between the speed and accuracy performance of those members of the experimental and control groups who typed on non-electric typewriters, and there was no significant difference between the speed and accuracy achievement of the experimental and control groups who used electric typewriters. Significant differences between the speed achievement of Level 1 experimental and control groups were found to exist at the .05 level of confidence; however, there was no significance between the accuracy achievement levels of these two groups. Mach did not report significant differences between the speed and accuracy achievement of the Level 2 and Level 3 experimental and control groups.

When the second three-minute straight-copy timed writing was administered during the 43rd class meeting, Mach found no significant difference between the control and experimental groups' speed achievement when electric typewriters were used and no significant difference in percentage level of accuracy of Level 1 experimental and control groups. The differences were not significant at the .05 level of confidence. There was significance reported between the speed and accuracy achievement of the experimental group and the control group using non-electric typewriters in favor of the experimental group and between the accuracy level of the experimental group and the control group using electric typewriters in favor of the experimental group at the .05 level of confidence. In

addition, significance was found to exist between the speed achievement of the Level 1, Level 2, and Level 3 experimental group and control group in favor of the experimental group at the .05 level of confidence. Further significance was found in favor of the experimental group at the .05 level between the accuracy achievement of the Level 2 and Level 3 experimental group and control group.

On the 65th class meeting when the final three-minute straight-copy timed writing was administered, Mach found no significant difference at the .05 level of confidence in the speed achievement of the experimental and control group using electric typewriters. However, significant difference was found to exist in favor of the experimental group between the accuracy achievement of the experimental and control groups using the electric typewriters, between the speed and accuracy achievement of the experimental and control group using non-electric typewriters, and also between the speed and accuracy achievement of the Level 1, Level 2, and Level 3 experimental and control groups. All of these differences were significant at the .05 level of confidence.

The Nemesh Study. The purpose of this study was to determine the effects of on-the-job training materials versus traditional copy materials with varying syllabic intensity on speed and accuracy in Typewriting I on the community college level.[8]

In her investigation, Nemesh used 50 typewriting students who were randomly assigned to either the experimental or control group after they

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[8]Mary Nemesh. An Experimental Study to Determine the Effects of On-The-Job Training Materials Versus Traditional Typewriting Copy Materials on Speed and Accuracy, Unpublished Doctoral Dissertation, University of Maryland, 1971.

had been randomly selected from the total population of Typewriting I classes from a selected community college in which GPA and ACT scores were made available. Before the actual experiment was begun, the subjects were pretested using a standard straight-copy timed writing for a measure of straight-copy speed and accuracy; and for a measure of production skills, Typewriting Achievement Test, Form A, First Year, was used. This production test was developed by the Psychological Corporation.

Nemesh's control group utilized the traditional copy materials presented in the textbook and supplementary drill books adopted by the college. Beginning with the fifth week and extending into the tenth week of classes, the experimental group used on-the-job training materials which were gathered from actual job situations. These materials were used for both practice and production work but not for testing purposes.

Tests used during the study consisted of five, five-minute timed writings and five, 30-minute production tests which were administered at one-week intervals. Once during the sixth, seventh, eighth, ninth, and tenth week, a five-minute timed writing and a 30-minute production test were administered. Nemesh made no attempt to control the syllabic intensity of the content of the timed writings or the production jobs; however, the practice materials and the testing materials for both groups were equated in terms of difficulty and format of copy.

At the end of the tenth week, a post-test was administered to determine the effects of the two treatments. A five-minute straight-copy timed writing and Typewriting Achievement Test, Form B, Alternate First Year were used as a measure of achievement and production during the study.

Nemesh used a 2 x 5 mixed design for orthogonal analyses of variance, utilizing the repeated measures program, and analyses of covariance for testing the hypotheses. The dependent variables were speed and accuracy with GPA and ACT test scores as covariates.

Nemesh's findings supported the use of on-the-job training materials in developing greater speed and accuracy. The two treatment groups differed significantly at the .05 level in both typewriting speed and in typewriting accuracy at the end of the study.

When Nemesh covariated the hypotheses with GPA and ACT scores, she found that these scores had no effect on the treatment groups and no significant difference between the experimental and the control group was found.

The Theis Study. The purpose of the Theis study was to determine if greater accuracy on three-minute timed writings is associated with a certain type of conditioning drill in third-semester high school typewriting.[9] In order to make this determination, three conditioning drills identified as C-1, C-2, and C-3 were selected on the basis of acceptable concepts of motor-skill learning and their use in various textbooks of noted authors in the field of typewriting instruction. Theis used the drills as part of a warming-up activity immediately preceding a straight-copy timing in typewriting at the third-semester level of skill development.

Two classes each from four high schools were chosen to participate in the study. From these classes, 134 members were selected which

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[9]Norman William Theis. A Typewriting Experiment to Compare Class Performance on Straight-Copy Three-Minute Writings Relative to Speed And Accuracy Following Three Selected Conditioning Drills, Unpublished Doctoral Dissertation, University of North Dakota, 1968.

represented 18 subjects in each group in schools number 1, 2, and 4, and 13 subjects in each group in school number 3. All groups were matched on the basis of sex, initial stroking ability, mean I.Q. score, and standard deviation. Performance in each school relative to speed and accuracy in the first three matching trials was not significantly different.

During the experimental period, all of the control groups in schools 1 and 3 were given the C-1 drill. The C-1 drill was structured for the purpose of building correct mind sets and to give special practice on different words, reaches, and letter sequences such as those which must be typed with one hand, and sentence fluency. The experimental groups in the same schools were given the C-3 drill to type at the beginning of each class period. The C-3 drill was composed so as to give the typist a mode of attach for solving the problem of discovering his or her optimum rate of speed at which he or she could type for longest durations without error.

In schools 2 and 4, the control groups were given the C-2 drill for daily warmup practice prior to the three-minute timed writing. This drill was designed primarily to assist the students in gaining confidence in typing at higher speed rates within a standard of a maximum of one error per minute or no errors for half-minute timed writings.

Each student in both the experimental and control groups was encouraged to type at different levels of speed: exploratory, faster, faster, and back for control. The three-minute timed writing for the experimental group of schools 2 and 4 was preceded by the C-3 drill which was also used by the experimental groups in schools 1 and 3.

Both groups in each school copied the same test material, operated under similar grading systems and other classroom conditions, and were required to achieve the same standard of accuracy--one error per minute. The materials copied during the C-2 and C-3 drills were also the same.

Twelve drills, one each week, were scheduled for each group. T-test comparisons were not made for all the trials because of the problem of absenteeism of the students. Only two "make-up" timings, given to each student individually under similar practice conditions, were permitted for each group of 18 subjects. Correspondingly, only one "make-up" timing was permitted for each of the 13 subjects. A timing also did not qualify for the t-test analysis if it were not taken within a period of five days after the originally scheduled timing or if the writing were unacceptable as a result of typewriter malfunctions.

Two comparisons of trials 11 and 12 were made for the purpose of determining whether greater increments in accuracy might be attributable to the continued use of the C-3 drill. In these two trials, the C-3 drill was chosen to precede the timing for both groups.

Theis's comparison of group exhibition of skill on straight-copy three-minute timed writings preceded by C-1 and C-3 drills revealed that the combined experimental groups whose timings followed the C-3 drill typed significantly more accurately than those in the combined control groups receiving the C-1 treatment. Further, Theis found that the mean number of errors registered by the experimental group in the two participating schools on timings preceded by the C-3 drill were lower in 10 of 11 trials; however, the difference between means reached the one per cent level of probability in only one trial. No significance was found between the mean stroking rates of the groups in either school.

Theis's findings relative to the comparison of group performance on straight-copy timings preceded by C-2 and C-3 drills indicated that:

1. The combined experimental groups whose timings followed the C-3 drill typed significantly more accurately than those in the combined control groups receiving the C-2 treatment.

2. The mean number of errors registered by the experimental groups in the participating schools on timings preceded by the C-3 drill were lower in all of the 16 trials in which the t-test comparisons were made, but the difference between the means reached the one percent level of significance in only one trial. The difference between means, based on the total number of words typed for the combined groups, was not significant.

The results of the final trial comparisons of Theis's experiment appeared to indicate that the control groups whose timings were preceded by the C-3 drill, registered a lower mean error rate than was recorded in any of their previous experimental trials. In some cases, the mean error rate registered by the control groups in these trials was lower than those of the experimental groups. However, the speed rates of the control and experimental groups did not vary significantly, except for the groups in school number 2. In this instance, the difference between the means reached the five percent level of probability.

The Tranquill Study. The Tranquill study was conducted to determine the effectiveness of individualized pacing in improving speed and accuracy in secondary school typewriting.[10] The study was delimited to

[10]Cecil Joseph Tranquill. The Effectiveness of Individualized Pacing in Improving Typewriting Speed and Accuracy, Unpublished Doctoral Dissertation, University of Pittsburgh, 1965.

three groups, each of which were composed of 82 students who were randomly selected from 13 classes taught by six different instructors in two high schools.

Tranquill composed his treatment groups by dividing the three classes into thirds. The three classes were Typewriting I, Typewriting II, and Transcription. One group of students were assigned to use the Strong-Pacer Electronic Pacing Equipment along with its accompanying drills which allowed for individualized pacing practice; in order to isolate the effects of the pacing equipment, a second group of students used only the drills which were specially designed for use with the pacing device; and a third group of students, the control group, used ordinary textbook materials. The experiment was conducted for approximately one semester with the first ten minutes of each class period set aside for the use of the special treatment techniques.

Typewriting achievement was measured in terms of gross words per minute and percentage of accuracy based on three different three-minute timed writings. One writing was straight copy, another was straight copy which emphasized numbers, and the third was straight copy which emphasized surnames. Each of these tests were administered twice during each of six testing sessions, and an average score for speed and percentage of accuracy was computed and analyzed. The tests administered during the semester included a pre-test, three periodic tests, a post-test, and a follow-up test.

At the termination of the study, Tranquill used the one-way analysis of covariance to analyze the data. He found that those students assigned to the pacer group achieved an increase in speed which was significantly greater than the achievement of the control group on all of the three

minute timed writings at the .05 level. The pacer group also achieved an increase in speed which was significantly greater than the achievement of the drill group on the numbers test and the straight-copy test. The difference was significant at the .05 level. Although the pacer group surpassed the drill group in speed on the surnames test, the difference in achievement between the two groups was not statistically significant.

The students assigned to the pacer group also achieved a significant increase in accuracy scores over the control group on the straight-copy test, the numbers test, and the surnames test. A comparison of the achievement of the pacer group and the drill group revealed that the increase in accuracy attained by the pacer group was significantly greater on the numbers test only. The slight advantage in accuracy achieved by the pacer group was not significantly greater than that of the drill group on either the straight copy or the surnames test. The difference was not significant at the .05 level of confidence.

The achievement of the drill group was greater than that of the control group on all tests; however, the difference was not significant on the straight-copy test, the numbers test used to assess speed, or on the three tests administered to measure accuracy. On the surnames test for speed, however, the achievement of the drill group was significantly greater than that of the control group.

When Tranquill analyzed the follow-up test, he discovered that the significant gains in speed achieved by the pacer group over the control group on the post-test were maintained on tests of straight copy and surnames. The significant gains in speed achievement by the pacer group over the control group were not maintained on the numbers test. In addition, he learned that the achievement of the pacer group over the

drill group on the straight copy and the numbers test was not maintained on the follow-up test. The achievement of the pacer group and the drill group on the surname test was not significantly different on the post-test or the follow-up test. These differences were not significant at the .05 level. The significant gains achieved by the drill group over the control group on the surnames test for speed decreased slightly but were nonetheless significant at the .05 level.

The significant gains in accuracy that were achieved by the pacer group over the control group at the end of the experiment decreased slightly on all three timed writings but remained significant. The difference in achievement between the pacer and the drill group on the straight-copy test for accuracy was not significant on either the post-test or the follow-up test. The achievement of the pacer group over the drill group on the numbers test for accuracy decreased slightly on the follow-up test but remained slightly greater. The follow-up test revealed that the pacer group achieved significant gains over the drill group on the surnames test for accuracy.

Tranquill also analyzed the data to determine the instructional level at which the pacing equipment appeared to be most effective. The pacer group from Typewriting I achieved significant gains in speed over the control group on the straight-copy test only.

The achievement of the Typewriting I pacer group on accuracy was significantly greater than that of the control group on the test of numbers and the test of surnames but not significantly greater on the straight-copy test. Although there were greater gains in accuracy by the pacer group than by the drill group on all tests, the difference was not significantly greater.

The students enrolled in the Typewriting II class who were assigned to the pacer group achieved gains in speed over the control group on all three tests. However, when the speed achievement of the pacer group and the control group was compared statistically, the gains were significant at the .05 level only on the numbers test and the surnames test. The gain in straight-copy accuracy by the pacer group over the drill group was significantly greater on the numbers test only. The pacer group's performance excelled the control group's performance in accuracy on all three tests; however, the gains were not significant. As was the case with the Typewriting I pacer group, the greatest gains in both speed and accuracy for the Typewriting II pacer group were achieved after the completion of the third phase of the experiment.

The transcription students who were assigned to the pacer group achieved some gains in speed over the control group; however, the gains were not great enough to be statistically different on any of the tests. The achievement of the Transcription pacer group was significantly greater than that of the drill group on the straight-copy test for speed only. The achievement of the pacer group was not significantly different from that of the drill group on the numbers and surnames tests for speed. The drill group achieved significantly greater gains than did the control group on the numbers test and the surnames test. On the straight-copy test, the control group achieved significantly greater gains than did the drill group.

On accuracy, the Transcription pacer group achieved significant gains over the control group on all three tests. Although the accuracy gains of the pacer group excelled that of the drill group on all three tests, these gains were not significant. An analysis of the periodic

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tests revealed that the third phase of the experiment was the most effective for the Transcription group who utilized the pacing equipment.

Tranquill also sought to determine if levels of intelligence influenced achievement in any of the three classes among students who were assigned to the pacer group. Of the 82 students assigned to the pacer group, 26 were classified as high in intelligence, 27 were classified as average in intelligence, and 26 were classified as low in intelligence. These classifications were made based on measures obtained from an administration of the Otis Gamma Test of Intelligence, Form AM. An informal study of the data revealed that the low-level pacer group achieved greater gains in speed and accuracy than the low-level control group on all three tests. The average-level pacer group achieved greater gains in speed and accuracy than did the average-level drill group, and the speed and accuracy achievement of the high-level pacer group was not as great as the achievement of the average and low-level pacer group when compared with the counterparts of the drill and the control groups.

The West Study. The purpose of the West study was to test the relative merits of mental-motor work-method sets toward forced speed and absolute accuracy in typewriting when differnetial practice totaling 200 minutes is introduced during the ninth week of the first semester of elementary typewriting in the secondary schools and maintained for 25 class periods thereafter.[11]

West's experimental design included the use of paired classes. Five pairs of classes in four New York City public high schools participated

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[11] Leonard Jordan West. Practice Sets Towards Speed and Accuracy in a Skill-Building Program in Elementary Typewriting, Unpublished Doctoral Dissertation, Columbia University, 1953.

in the experiment. Each pair of classes was taught by a different instructor; two of the five instructors were in the same school, and each of the other three instructors was in a different school. One class in each of the pairs was designated as the speed-set class and the other as the accuracy-set class.

Each class was composed of 20 subjects thereby constituting a total of 200 subjects participating in the experiment. The speed-set group was composed of 100 students and the accuracy-set group was composed of 100 students. The students were equated on the following bases: (1) initial typewriting status, (2) chronological age, (3) mental age, (4) out-of-class practice, and (5) absences.

The experimental typing consisted of 200 minutes of practice time and 40 minutes of test work which was spread over a 25-day period. Practice schedules were arranged so that each day's experimental work consumed approximately 15 minutes of each 40-minute class period. The remaining 25 minutes were devoted to usual typewriting activities.

West's experimental work was specifically selected to be a skill-building program which was to be introduced during the middle of the term. The instructional materials consisted of a series of sentences and paragraphs of gradually increasing length from 15 to 375 strokes and an accompanying table which allowed for instant determination of typewriting speed. The materials distributed daily to each student were collected immediately upon completion of the experimental practice for the day. The vocabulary used in the sentences and paragraphs was considered to be an "everyday" vocabulary by West and was not selected according to any particular qualitative criteria. The practice time on these materials was in short spurts of 20, 30, and 60 seconds.

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Each student in the accuracy-set class began practice on a sentence or a paragraph which when completed within the allotted time equalled the student's current typewriting speed. If the student completed the material selected without error within the allotted time, he or she was to proceed to the next longer sentence and type it until perfection and completion were achieved. If the sentence were both errorless and complete, the student had achieved criteria. If criteria were not achieved, the student kept typing the same sentence until the entire sentence could be typed without error.

All typing was done under the precisely timed conditions set by the instructors, and the student continued typing each day where he had left off on the preceding day. Twenty-five percent of the practice time used by the speed-set class was conducted according to the same completion-perfection standards which were set for the accuracy-set class. Seventy-five percent of the practice time was devoted to a speed-only or a completion-only criterion. Selection of the initial sentence was in the same manner as for the accuracy-set class. The conditions of practice were identical for the two groups except for the criterion for progress to the next longer sentence. Daily practice began with speed work aimed solely toward completion of the sentence regardless of errors, and speed was forced to its maximum. The speed spurts were followed by one or two timings which were completed according to the same criteria set for the accuracy-set class. When the speed-set classes were switched from speed to accuracy, explicit instructions were given the students by the instructors in order to facilitate a smooth transition.

West used the analysis of covariance to analyze his data which involved initial strokes, final strokes, initial errors, and final errors.

The results of the statistical test that in a 200-minute skill-building program covering five weeks beginning at the middle of the first semester of typewriting, practice forced at maximum speeds would produce higher rates on criterion timings on new copy than would practice oriented primarily toward absolute perfection of typescript should be rejected. The difference between the accuracy-set group and the speed-set group was significant at the .05 level of confidence.

The hypothesis that practice oriented primarily toward absolute perfection of typescript would result in greater accuracy on criterion timings than would practice forced at maximum speed was supported by the data. Although the speed-set group and the accuracy-set group experienced an increase in error frequency when compared with their initial performances, they were both relatively more accurate at the end of the experiment in terms of errors committed per stroke. The difference between the performance of the two groups was significant at almost the .01 level of confidence in favor of the accuracy-set group.

West also found that there was no significant difference between the performance of the speed-set group and the accuracy-set group when they were retested after several months of instruction by different instructors when such instruction was largely devoted to production typewriting. However, the accuracy-set group was faster and more accurate than was the speed-set group. West explains the effects of three to five months of practice oriented toward office standards of accuracy under different instructors is such as to reduce or to remove the performance differences established earlier by the differential practice sets toward forced speed and perfection of typescript.

SUMMARY OF THE REVIEWED LITERATURE

One of the similarities among the studies reviewed is the investigators' perceptions of the inadequacy of the composition of the drill materials included in most typewriting textbooks which are currently on the market. Specifically, the investigators questioned the effectiveness of these drill materials in developing high levels of straight-copy speed and accuracy which can be easily transferred to comparable levels of production skills. One of the goals of each of the studies appeared to be that of accomplishing such transfer with a minimum of readjustment of typewriting patterns on the part of the learner.

Weaver investigated the impact which various alphabet and punctuation stroking have upon a learner of typewriting as he or she progresses through various speed levels on an electric or manual typewriter. One of Weaver's discoveries was that electric typewriters significantly increased stroking rates over manual machines. Another discovery was that significance existed between right handedness on electric typewriters versus left handedness on manual typewriters and double-letter strokes on electric typewriters versus consecutive-finger strokes on manual typewriters. The third discovery was that double-letter stroke accuracy on manual typewriters significantly decreased the incidents of error over consecutive-finger strokes on electric typewriters.

The Byford study made inquiry into the use of typewriting drills containing language arts concepts in improving language arts knowledge and in improving typewriting speed and accuracy in second semester high school classes. Byford found that the experimental groups who typed

the language arts concept drills gained significantly more knowledge of these concepts than did the control group but that the language arts drills had very little positive or negative effect on the typewriting speed and accuracy of the experimental group.

The Crawford study was conducted for the purpose of determining the effects of emphasizing production typewriting contrasted with speed typewriting in developing production typewriting skills. Discoveries made by Crawford were that the production-emphasis method produced significantly greater production ability than did the speed-emphasis method of teaching typewriting and that high levels of straight-copy speed do not necessarily transfer to production typewriting tasks.

The purpose of the Dodson study was to attempt to determine the effects of interesting copy materials, in the form of short stories, on typewriting speed and accuracy achievement as opposed to traditional textbook drills which were designated as uninteresting copy materials. One set of interesting materials was prepared for males; and another set, employing a slightly different theme, was prepared for females. The results of the study revealed that the males who were assigned to type from interesting materials tended to commit more errors than did those males who typed from non-interesting copy materials, but the difference was not significant. Both groups of males experienced a decrease in base speed; however, the males typing from interesting copy materials experienced a smaller decrease in speed than did those males typing from non-interesting copy materials. This difference was significant at the .05 level. The females who typed from the interesting copy materials committed significantly fewer errors than did those females who typed from non-interesting copy materials; however, the females who

typed from interesting copy materials decreased in speed while those females who typed from non-interesting copy materials experienced a gain in speed. The difference between the speed achievement of the females was significant.

In two studies, one a modified replication of the other, Gades and Johnson attempted to determine the effects of short-duration high-speed drills on speed and accuracy achievement versus conventional procedures recommended by current textbooks. The experimental period of the original study, the Johnson study, covered one semester. The replicated study, the Gades study, was conducted for a full year and included the variable of production typewriting. Johnson learned that the experimental group achieved significantly greater speed and accuracy on one-minute and five-minute timed writings than did the control group. The Gades study revealed that although the experimental group excelled the control group in speed and accuracy achievement on one-minute and five-minute timed writings, the difference was not significant. However, on the standardized production test which was administered at the end of the study, the experimental group performed significantly better than did the control group.

Mach challenged the repetitive-drill method of improving speed and accuracy achievement. The use of repetitive drills, which has long been accepted as standard procedures for warm-up practice, was contrasted with the efficiency of non-repetitive drills in facilitating speed and accuracy. In addition, the study was conducted to ascertain whether repetitive drills practice would lead to higher skill levels between the upper third, the middle third, or the lower third of each group when ranked according to speed achievement. The study further sought to determine if the two contrasting methods would produce any significant difference between those

students using non-electric typewriters and those using electric typewriters. Upon the termination of the study, there was no significant difference at the .05 level between the speed and accuracy achievement of the experimental group and the control group using electric and non-electric typewriters on three-minute timed writings even though the experimental group performed slightly better. Significant differences between the speed achievement of the upper third experimental group and the control group was found to exist at the .05 level; however, there was no significance between the accuracy achievement levels of these two groups. In addition, there was no reported significance between the speed and accuracy achievement of the middle-third and the lower-third experimental groups and control groups.

Nemesh took exception to the lack of on-the-job training materials in sufficient quantity to develop those marketable vocational typewriting skills demanded in the real world of work and based his study on the use of realistic typewriting tasks as practice materials. The results of the study indicated that while the use of on-the-job training materials could lay the foundation for maximizing efficiency on the job, there was no significant difference between the experimental groups and the control groups on production speed and accuracy. However, on five-minute timed writings there was a significant difference between the experimental groups and the control groups on speed and accuracy performance in favor of the experimental groups.

Specially constructed drill materials designed to conform to acceptable concepts of motor-skill learning were utilized in the Theis study as conditioning drills. The experimental method required that these conditioning drills precede each timed writing as a means of ascertaining

their effect on speed and accuracy achievement. The drills were designated as C-1, C-2, and C-3. When a comparison was made of the timed writings which were preceded by each of the conditioning drills, significant differences in speed and accuracy performance were discovered in favor of students using the C-3 drill.

The Tranquill study utilized a commercially manufactured individualized pacing device with accompanying drills as its experimental testing method. The three categories of tests used to measure the effectiveness of the treatments were straight-copy tests, straight-copy tests emphasizing numbers, and straight-copy tests emphasizing surnames. The pacer group performed significantly more accurately than did the control group on all three types of tests. In addition, the pacer group achieved an increase in speed which was significantly greater than the achievement of the control groups on the straight-copy timed writings and an increase in speed which was significantly greater than the achievement of the drill group on the numbers tests and the straight-copy tests. Although the pacer group surpassed the drill group in speed on the surnames tests, the difference in achievement between the two groups was not significant.

The West study tested the merits of mental-motor work methods sets toward forced speed and absolute accuracy in typewriting when differential practice totaling 200 minutes is introduced during the ninth week of the first semester of elementary typewriting in the secondary schools and maintained for 25 class periods thereafter. West learned that practice forced at maximum speeds would not produce higher typewriting speed on new copy than would practice oriented toward absolute accuracy. The experimental group whose practice was oriented toward typescripts which

were errorless typed significantly faster and more accurately than did the speed-emphasis group.

One of the more noteworthy features of each of the reviewed studies is that each of the investigators concluded that the experimental treatments resulted in speed and accuracy performance which exceeded that of the students receiving the control treatment. However, in some cases, these differences were not significant.

Some of the investigators suggested that the format of textbook typewriting drills be re-examined for possible revision while all invaribly recommended that their studies be replicated on a larger scale for an extended period of time utilizing the same or similar test methods in order to authenticate their findings.

CHAPTER III

METHODS AND PROCEDURES

Four types of drill materials were contrasted in this study in order to attempt to determine the effectiveness of each type of copy in developing straight-copy speed and accuracy and production speed and accuracy. The study also attempted to determine whether levels of intelligence played an integral part in typewriting achievement.

The subjects who participated in this seven-week study were 95 students who were enrolled in five intact classes in intermediate collegiate typewriting. Two of the classes were students who were enrolled at Alcorn State University located in Lorman, Mississippi; one of the classes was made up of students who were enrolled at Jackson State University in Jackson, Mississippi; and two of the classes were students who were enrolled at Mississippi Valley State University located in Itta Bena, Mississippi.

The results of an administration of the Otis Quick-Scoring Mental Ability Test (Form EM) were used as a means of grouping students into upper-ability and lower-ability categories. This test has a split-half reliability coefficient of .88 and a mean validity index of approximately .50.[1] The mental ability scores were arranged in descending order to determine which group of students would be classified as upper ability and which group would be classified as lower ability. (See Appendix B for the mental ability scores for each of the 95 subjects). The scores

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[1]Arthur S. Otis. Manual of Directions for Gamma Test, (New York: World Book Company, 1954, pp. 5-6.

were cut off at the approximate mid-point with 47 students assigned to the upper-ability group and 48 students assigned to the lower-ability group. In order to divide the two groups as evenly as possible, it was necessary to slightly overlap the categories; thus, the groups were not mutually exclusive. Three students with mental abilities of 90 were assigned to the upper-ability group, and all other students with mental abilities of 90 were assigned to the lower-ability group. The results of the Otis Quick-Scoring Mental Ability Test were also used as a means of equating the groups on the basis of mean mental ability scores. The one-way analysis of variance test was used to determine if any of the four treatment groups were significantly different from the other at the outset of the study. Table 3.1 shows a summary of the one-way analysis of variance test.

TABLE 3.1

ONE-WAY ANALYSIS OF VARIANCE OF ABILITY LEVELS ACROSS THE FOUR TREATMENT GROUPS

Sources of Variation	Sums of Squares	df	Mean Squares	F Ratio	p
Between Groups	4816.8015	3	1605.6005	138.8222	$p < .0001$*
Within Groups	3157.4858	91	34.697646		
Totals	7974.2873	94			

*Significance at the .05 level of confidence

The obtained F-ratio value of 138.8222 was larger than the critical value of 2.70 for 3 and 91 degrees of freedom at the .05 level of confidence and indicates a significant difference among the mean mental abilities

of the four treatment groups. In order to determine which groups were significantly different from the other, the Scheffe'post hoc procedure was used. Table 3.2 presents a summary of the comparisons of the differences between all possible pairs of mental ability mean scores for the four treatment groups.

TABLE 3.2

SUMMARY OF THE CONFIDENCE INTERVALS AROUND THE DIFFERENCES BETWEEN THE MEAN MENTAL ABILITY LEVELS OF THE FOUR TREATMENT GROUPS USING THE SCHEFFE' METHOD

Contrasts	Differences Between Means	Confidence Interval
Group I vs. Group II (Computerized Drill Books vs. Magazine drills)	90.58 - 93.65 = -3.07	(1.813, -7.953)
Group I vs. Group III (Computerized Drill Books vs. Textbook Drills)	90.58 - 88.04 = 2.54	(7.423, -2.343)
Group I vs. Group IV (Computerized Drill Books vs. No Drills)	90.58 - 93.28 = -2.70	(2.082, -7.482)
Group II vs. Group III (Magazine Drills vs. Textbook Drills)	93.65 - 88.04 = 5.61	(10.544, 0.676)*
Group II vs. Group IV (Magazine Drills vs. No Drills)	93.65 - 93.28 = 0.37	(5.204, -4.464)
Group III vs. Group IV (Textbook Drills vs. No Drills)	88.04 - 93.28 = -5.24	(-0.406, -10.074)*

*Significance at the .05 level of confidence

only two of the six comparisons of mean mental ability scores for the four treatment groups included indicated a significant difference. The confidence interval generated for the comparison between Group II combined and Group III combined (magazine drills and textbook drills) and the confidence interval generated for the comparison between Group III and Group IV (textbook drills and no drills) did not span zero. Consequently, it appears logical to expect Group II to achieve a significantly higher level of typewriting speed and accuracy than would Group III; and likewise, that Group IV would achieve higher levels of typewriting speed and accuracy than would Group III.

A typewriting pre-test consisting of two, three-minute timed writings and a production test were administered prior to the initiation of the study in order to determine the typewriting proficiency of the students. (See Appendix C for a copy of the pre-test). The production typewriting section of the pre-test consisted of a manuscript, a news release containing rough-draft marks, and a letter containing rough-draft marks and tabulations. The test was timed for 30 minutes and contained a total of 1,097 words.

Upon the termination of the study, a post-test consisting of the same copy for the three-minute timed writing and a production test of different copy but of the same type of typewriting tasks were administered. (See Appendix D for a copy of the post-test). The results were used to measure the effects of exposure to the four treatments. The post-test was timed for 30 minutes and contained a total of 1,186 words. (See Appendix E for a copy of the letter requesting permission to use the materials which were included in the pre-test and the post-test and for a copy of the letter granting permission to use the materials). Validity

coefficients for the pre-test and the post-test used in this study were not derived by the investigator. However, in the White study in which the pre-test and the post-test were similar to those used in this study, a biserial correlation of .5948 was obtained.[2] In addition, an examination of several collegiate typewriting textbooks currently on the market revealed that their prescribed typewriting tasks were comparable in content and length to the tasks included in the tests used in this study.

The straight-copy timed writings were measured in terms of gross words per minute. The production test scores were obtained by using the grading scale suggested in the instructor's manual which accompanied the textbook from which the pre-test and the post-test were taken. The grading scale which was used is as follows:

1. Three points off for incorrect form and incorrect placement
2. Two points off for each technical error such as forgetting to center a line, indent a paragraph, or leave a blank line between paragraphs
3. One point off for each typographical error[3]

For analyses purposes, only the better of the two, three-minute timed writings which were included in both the pre-test and the post-test were used. The students' pre-test and their post-test scores were compared in order to derive a measure of their levels of achievement on straight-copy speed and accuracy and on production speed and accuracy as a result of exposure to one of the four experimental treatments. The two-way analysis

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[2]Kathryn Fern White. An Experimental Study Utilizing Varied Scheduling Out-of-Class Assignments in Intermediate Collegiate Typewriting, Unpublished Doctoral Dissertation, Oklahoma State University, 1974.

[3]Alan C. Lloyd, John L. Rowe, and Fred E. Winger. Instructor's Manual and Visual Key for Advanced Typing 75, (New York: McGraw-Hill Book Company, 1971), p. 27.

of variance technique was used to determine whether significance existed between mean achievement levels on straight-copy speed and accuracy and on production speed and accuracy for the four treatment groups. When instances of significance occurred, the Scheffé post hoc procedure was used to ascertain which pair of means contributed to or was responsible for the rejection of the null hypothesis.

Approximately one-fourth of the students from each class at each university was randomly assigned to one of the four treatment groups by drawing a numbered slip of paper from a box. Students assigned to Group I typed drills from a computerized drill book entitled Selective Practice Typing Drills by Alan C. Lloyd, Robert P. Poland, John L. Rowe, Fred E. Winger, and William Griffith. (See Appendix E for a copy of the letter requesting free copies of the book to be used in the experiment). The drill book was composed of copy specifically designed to analyze the student's typewriting errors. Depending upon the number of errors which were committed on the first three-minute timed writing, the student is directed by instructions contained in the book to type a remedial drill which is geared either toward developing greater speed or greater accuracy. The students assigned to Group III typed paragraphs which they selected themselves from Ebony magazines, the students assigned to Group III typed preparatory drills from the textbooks which were currently being used at their respective universities, and Group IV students did not type warm-up drills. Group IV proceeded to type those production tasks which were assigned by their instructors.

Fifteen minutes of each class day were devoted to the experimental drill practice and one, three-minute timed writing. Each treatment group, with the exception of Group IV, typed and quickly scored a three-minute

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timed writing at the beginning of each class period; and the remainder of the 15 minutes was devoted to additional drill practice. After the 15 minutes of drill practice were completed, the remainder of the class period was conducted according to the discretion of the typewriting instructors.

Data resulting from the study will be analyzed in the following chapter.

CHAPTER IV

ANALYSIS OF THE DATA

This chapter presents a discussion of the data collected from the typewriting experiment and the results of the statistical treatment of the data using the two-way analysis of variance technique. The sources of data include an administration of the Otis Quick-Scoring Mental Ability Test which was used to determine ability groupings, a pre-test which was used to ascertain the typewriting proficiency of the students prior to the initiation of the study, and a post-test which was used to determine the effects of the four experimental treatments on typewriting achievement. The data were punched on cards and analyzed by computer at the Michigan State University Computer Center. The computer program used was Multivariance--Version 4 June 1968 by Jeremy D. Finn, Department of Educational Psychology, State University of New York at Buffalo which was modified for the Michigan State University CDC 3600 and 6500 computer systems by Verda Scheifley and William Schmidt.

The data were analyzed to make the following determinations:

1. The effects of types of drill materials on straight-copy speed in intermediate collegiate typewriting

2. The effects of levels of intelligence on straight-copy speed in intermediate collegiate typewriting

3. The effects of an interaction between types of drill materials and levels of intelligence on straight-copy speed in intermediate collegiate typewriting

4. The effects of types of drill materials on production-copy speed in intermediate collegiate typewriting

5. The effects of levels of intelligence on production-copy speed in intermediate collegiate typewriting

6. The effects of an interaction between types of drill materials and levels of intelligence on production-copy speed in intermediate collegiate typewriting

7. The effects of types of drill materials on straight-copy accuracy in intermediate collegiate typewriting

8. The effects of levels of intelligence on straight-copy accuracy in intermediate collegiate typewriting

9. The effects of an interaction between levels of intelligence and types of drill materials on straight-copy accuracy in intermediate collegiate typewriting

10. The effects of types of drill materials on production-copy accuracy in intermediate collegiate typewriting

11. The effects of levels of intelligence on production-copy accuracy in intermediate collegiate typewriting

12. The effects of an interaction between types of drill materials and levels of intelligence on production-copy accuracy in intermediate collegiate typewriting

When instances of significance occurred, the Scheffe' post hoc procedure was employed. The purpose of this procedure was to isolate the comparisons between the treatment means which were responsible for or contributed to the rejection of the null hypothesis.

The discussion of the analysis of the data is reported in two parts under the following headings:

Part I - Statistical Analysis of the Data

Part II - Non-Statistical Analysis of the Data

I. STATISTICAL ANALYSIS OF THE DATA

As the study involves a two-factor design, the two-way analysis of variance technique was used to analyze the data. The two factors of the analysis of variance were treatment with four levels and intelligence with two levels. The four types of treatment were computerized drill books, magazine drills, textbook drills, and no drills. The two levels of intelligence were upper ability and lower ability.

This section of the chapter will present a discussion of the two-way analysis of variance tests which was used to analyze each of the four dependent variables. The four dependent variables were speed on straight-copy timed writings, speed on production copy, accuracy on straight-copy timed writings, and accuracy on production copy.

Analysis of the data on speed on straight-copy timed writings

Two, three-minute straight-copy timed writings were included in the pre-test and in the post-test. The pre-test timed writings were administered prior to the initiation of the study to determine the levels of the students' straight-copy typewriting skills. The post-test three-minute timed writings were administered at the termination of the study in order to measure the effects of exposure to the four experimental treatments. For purposes of analysis, only the better of the two pre-test timed writings was used; and only the better of the two post-test timed

writings was used. The students' pre-test scores were compared with their post-test scores, and means were computed from the pre-test scores and the post-test scores for each of the treatment groups.

This study included three hypotheses relative to the development of straight-copy speed. The first of these three hypotheses was restated for statistical testing purposes in the null form as follows: There is no significant difference in straight-copy speed developed in intermediate collegiate typewriting among the types of drill materials used. The results of the statistical test revealed that this null hypothesis should be rejected. The two-way analysis of variance test of the differences among the combined group means is summarized in Table 4.1 below.

TABLE 4.1

TWO-WAY ANALYSIS OF VARIANCE OF TREATMENT GROUPS AND ABILITY LEVELS ON STRAIGHT-COPY SPEED

Sources of Variation	Sums of Squares	df	Mean Squares	F Ratio	p
Types of Drill Materials	197.3595	3	65.6865	4.2271	$p < .0078$*
Ability Levels	5.1442	1	5.1442	.3305	$p < .5669$
Interaction of Drill Materials and Ability Levels	18.4692	3	6.1564	.3956	$p < .7565$
Within Cells	1353.9744	87	15.562925		
Totals	1574.9473	94			

*Significance at the .05 level of confidence

An F-ratio value of 4.2271 was obtained when the differences among the means of the four treatment groups were tested. That value was larger than the ctirical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and extended into the rejection region. Therefore, the null hypothesis that there is no significant difference in straight-copy speed developed in intermediate collegiate typewriting among the types of drill materials used was rejected.

In order to determine which treatment groups were responsible for or contributed to the rejection of the null hypothesis, the Scheffé post hoc procedure was used. Table 4.2 presents a summary of the comparisons of the differences between all possible pairs of treatment means.

TABLE 4.2

SUMMARY OF CONFIDENCE INTERVALS AROUND THE DIFFERENCES BETWEEN THE MEANS OF THE FOUR TREATMENT GROUPS USING THE SCHEFFÉ METHOD

Contrasts	Differences Between Means	Confidence Interval
Computerized Drill Books vs. Magazine Drills	2.417 - 2.826 = -0.409	(-3.689, 2.880)
Computerized Drill Books vs. Textbook Drills	2.417 - 4.348 = -1.931	(-5.220, 1.358)
Computerized Drill Books vs. No Drills	2.417 - 5.880 = -3.463	(-6.686, -0.240)*
Magazine Drills vs. Textbook Drills	2.826 - 4.348 = 1.522	(-4.845, 1.801)
Magazine Drills vs. No Drills	2.826 - 5.880 = -3.054	(-6.312, 0.204)
Textbook Drills vs. No Drills	4.348 - 5.880 = -1.532	(-4.790, 1.726)

*Significance at the .05 level of confidence

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Only the confidence interval generated for the comparison between the computerized drill books group (Group I) and the no drills group (Group IV) did not span zero. This finding indicates a significant difference between the two treatment groups at the .05 level of confidence. An examination of the combined group means in the second column of Table 4.2 on page 65 reveals that the difference was significant in favor of the no drills group (Group IV) which attained a mean increase of 5.880 gross words per minute during the course of the experiment. Thus, the inference can be made that the students assigned to the no drills group were able to attain a significantly greater level of straight-copy speed than were the students assigned to the computerized drill books group as a result of exposure to this treatment.

The second of the three hypotheses regarding the development of straight-copy speed involved the effects of levels of intelligence on straight-copy speed achievement. For statistical testing purposes, the hypothesis was restated in null form as follows: There is no significant difference between levels of intelligence and straight-copy speed achievement in intermediate collegiate typewriting. The results of the statistical test disclosed that the hypothesis should be retained. The two-way analysis of variance test of the differences in straight-copy speed achievement among the combined groups with respect to levels of intelligence is given in Table 4.1 on page 64.

An F-ratio value of .3305 was obtained when the differences among the speed gains of the combined groups were tested. That value was smaller than the critical value of 3.96 for 1 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. Consequently, the null hypothesis that there is no difference

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between levels of intelligence and straight-copy speed achievement in intermediate collegiate typewriting was retained. It appears correct to generalize, therefore, that levels of intelligence do not play a role in straight-copy speed achievement in intermediate collegiate typewriting.

The last hypothesis which explored straight-copy speed achievement focused on the effects of an interaction between types of drill materials used and levels of intelligence on the development of straight-copy speed. The hypothesis was restated in null form for statistical testing purposes as follows: There is no significant difference in straight-copy speed achievement as a result of an interaction between levels of intelligence and types of drill materials used. The two-way analysis of variance test of the interaction between types of drill materials used and levels of intelligence is presented in Table 4.1 on page 64.

An F-ratio value of .3956 was obtained for this test. That value was smaller than the critical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. Thus, it follows that the null hypothesis that there is no significant difference in straight-copy speed achievement as a result of an interaction between levels of intelligence and types of drill materials used should be retained. This test appears to indicate that the combination of intelligence and types of drill materials used is not a salient factor in the attainment of straight-copy speed in intermediate collegiate typewriting.

Analysis of the data on speed on production copy

A 30-minute production-copy pre-test was administered to students participating in the study in order to ascertain a measure of previously

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acquired production typewriting skills. The pre-test consisted of a manuscript, a news release containing rough-draft marks, and a letter containing rough-draft marks and tabulations. The contents of the 30-minute post-test were similar to that of the pre-test. The post-test was administered upon the completion of the study in order to generate data with which to compare the pre-test results and to establish the extent of the increment in speed in production typewriting.

Three hypotheses associated with production-copy speed were incorporated in this study. The first hypothesis was restated for statistical testing purposes in the null form as follows: There is no significant difference in production-copy speed developed in intermediate collegiate typewriting among the types of drill materials used. The results of the statistical test revealed that this null hypothesis should be retained. The two-way analysis of variance test of the differences among the combined group means on types of drill materials used is shown in Table 4.3.

TABLE 4.3

TWO-WAY ANALYSIS OF VARIANCE OF TREATMENT GROUPS AND ABILITY LEVELS ON PRODUCTION-COPY SPEED

Sources of Variation	Sums of Squares	df	Mean Squares	F Ratio	p
Types of Drill Materials	36.2934	3	12.0978	.7608	$p < .5192$
Ability Levels	81.0185	1	81.0185	5.0949	$p < .0266$*
Interaction of Drill Materials and Ability Levels	42.1131	3	14.0377	.8828	$p < .4534$
Within Cells	1383.4594	87	15.901833		
Totals	1542.8844	94			

*Significance at the .05 level of confidence

The derived F-ratio value of .7608 was smaller than the critical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. Hence, the null hypothesis that there is no significant difference in production-copy speed developed in intermediate collegiate typewriting among the types of drill materials used was retained. The results of the test permit one to make the assumption that each of the four types of drill materials utilized in the study were almost equally effective in developing production-copy speed.

The second hypothesis with respect to the development of production-copy speed made inquiry into the effects of levels of intelligence on achievement in this area. The hypothesis was restated for statistical testing purposes in the null form as follows: There is no significant difference between levels of intelligence and production-copy speed achievement in intermediate collegiate typewriting. The results of the statistical test required that the null hypothesis be rejected. The two-way analysis of variance test of the differences in production-copy speed achievement among the combined groups relative to levels of intelligence is displayed in Table 4.3 on page 68.

An F-ratio value of 5.0949 was calculated when the differences among the mean production-copy speed gains of the combined groups were tested. That value of 5.0949 was larger than the critical value of 3.96 for 1 and 87 degrees of freedom at the .05 level of confidence and did extend into the rejection region. Therefore, the null hypothesis that there is no significant difference between levels of intelligence and production-copy speed achievement in intermediate collegiate typewriting was rejected.

As the study included only two levels of intelligence, upper ability and lower ability, it was not necessary to construct Scheffe' method confidence intervals in order to determine which pair of means was responsible for or contributed to the rejection of the null hypothesis. An examination of Table 4.4 will reveal that the significant difference between the production-copy speed achievement of the two combined groups of upper-ability students and lower-ability students was in favor of the combined group of lower-ability students. This finding will be discussed in the non-statistical analysis section of this chapter.

TABLE 4.4

MEAN PRODUCTION-COPY SPEED GAINS FOR THE COMBINED GROUPS OF UPPER-ABILITY STUDENTS AND THE COMBINED GROUPS OF LOWER-ABILITY STUDENTS IN THE FOUR TREATMENT GROUPS

Ability Levels	Mean Production Speed Gain
Upper Ability	3.340
Lower Ability	5.187

The combined group of lower-ability students achieved a mean gain of 5.187 gross words per minute and the combined group of upper-ability students achieved a mean gain of 3.340 gross words per minute, yielding a mean difference between the performance of the two groups of 1.847 gross words per minute.

The data tend to suggest that a student's mental ability does somewhat influence the level of achievement in production-copy speed. However, in this instance, the relationship between the two factors appears to be inverse.

The third of the hypotheses relating to production-copy speed achievement was associated with the effects of an interaction between levels of intelligence and typed of drill materials used. The hypothesis was restated for statistical testing purposes in null form as follows: There is no significant difference in production-copy speed achievement as a result of an interaction between types of drill materials used and levels of intelligence. The two-way analysis of variance test of the interaction between types of drill materials used and levels of intelligence is presented in Table 4.3 on page 68 and indicates that the null hypothesis should be retained.

An F-ratio value of .8828 was computed for this test. That value was smaller than the critical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. This signifies that the null hypothesis that there is no significant difference in production-copy speed achievement as a result of an interaction between types of drill materials used and levels of intelligence should be retained. Thus, it appears accurate to conclude that the combined factors of types of drill materials used and levels of intelligence were indistinguishable in influencing achievement in production-copy speed in this study.

Analysis of the data on accuracy on straight-copy timed writings

The two, three-minute pre-test and post-test straight-copy timed writings which were used to determine the students' levels of straight-copy speed were also used to determine the levels of their straight-copy accuracy. The percentage of accuracy of the number of gross words typed per minute on the pre-test timed writing was compared with the percentage of

accuracy of the number of gross words typed per minute on the post-test timed writing. From this data, means were computed for each of the treatment groups.

Three of the hypotheses in this study pertained to the development of straight-copy accuracy. The first of the three hypotheses was restated for statistical testing purposes in the null form as follows: There is no significant difference in straight-copy accuracy development in intermediate collegiate typewriting among the types of drill materials used. The results of the statistical test indicated that this null hypothesis should be retained.

Table 4.5 is a summary of the two-way analysis of variance test of the differences among the combined means of the straight-copy accuracy scores for the four treatment groups.

TABLE 4.5

TWO-WAY ANALYSIS OF VARIANCE OF TREATMENT GROUPS AND ABILITY LEVELS ON STRAIGHT-COPY ACCURACY

Sources of Variation	Sums of Squares	df	Mean Squares	F Ratio	p
Types of Drill Materials	44.8737	3	14.9579	.2564	$p < .5830$
Ability Levels	17.7240	1	17.7240	.3038	$p < .8566$
Interaction of Drill Materials and Ability Levels	85.1007	3	28.3669	.4863	$p < .6928$
Within Cells	5057.2027	87	58.335713		
Totals	5222.9054	94			

An F-ratio value of .2564 was calculated when the differences among the means of the four treatment groups were tested. That value was smaller than the critical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. As a result, the null hypothesis that there is no significant difference in straight-copy accuracy development in intermediate collegiate typewriting among the types of drill materials used was retained. Consequently, it appears credible to assume that the types of drill materials had almost equal effects on the straight-copy accuracy achievement of the four treatment groups.

The second hypothesis concerning straight-copy accuracy made inquiry into the effects of levels of intelligence on straight-copy accuracy achievement. For statistical testing purposes, the hypothesis was restated in null form as follows: There is no significant difference between levels of intelligence and straight-copy accuracy achievement in intermediate collegiate typewriting. The results of the statistical test indicated that the hypothesis should be retained. The summary of the two-way analysis of variance test of the differences among the combined means of the straight-copy accuracy scores for levels of intelligence is included in Table 4.5 on page 72. The computed F-ratio value of .3038 was smaller than the critical value of 3.86 for 1 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. Hence, it appears logical to assume that levels of intelligence produced little variance among the treatment groups in straight-copy accuracy achievement in this study.

The last hypothesis involving straight-copy accuracy sought to determine the extent of an interaction between types of drill materials used

and levels of intelligence on achievement in this area. The hypothesis was restated in null form for statistical testing purposes as follows: There is no significance difference in straight-copy accuracy achievement as the result of an interaction between levels of intelligence and types of drill materials used. The statistical test indicated that there was no significant interaction between the two factors and that the hypothesis should be retained. Table 4.5 on page 72 may be referred to for a summary of the two-way analysis of variance test of the interaction between types of drill materials used and levels of intelligence on straight-copy accuracy. The derived value of .4863 was less than the critical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. Under these conditions, the test suggests that the combined factors of types of drill materials used and levels of intelligence did not contribute in greater degree to the straight-copy accuracy achievement of one treatment group than to any other of the three treatment groups.

Analysis of the data on accuracy on production copy

The 30-minute production-copy pre-test and the 30-minute production-copy post-test which were used to obtain a measure of the students' production-copy typewriting speeds were also used to obtain a measure of the students' production-copy accuracy levels. The accuracy levels were computed in terms of percentages, and a comparison was made between the percentages of accuracy on both the pre-test results and the post-test results. Means were computed for each of the treatment groups in order to assess gains in accuracy levels as a result of exposure to the experimental treatments.

In this study, three of the hypotheses explored the development of production-copy accuracy. The first of the three hypotheses was restated for statistical testing purposes in the null form as follows: There is no significant difference in production-copy accuracy development in intermediate collegiate typewriting among the types of drill materials used. The outcome of the statistical test warranted that this hypothesis should be retained.

A compilation of the two-way analysis of variance test of the differences among the combined means of the production-copy accuracy data for the four treatment groups is given in Table 4.6.

TABLE 4.6

TWO-WAY ANALYSIS OF VARIANCE OF TREATMENT GROUPS AND ABILITY LEVELS ON PRODUCTION-COPY ACCURACY

Sources of Variation	Sums of Squares	df	Mean Squares	F Ratio	p
Types of Drill Materials	397.6032	3	132.5344	.4240	$p < .7363$
Ability Levels	6.7638	1	6.7638	.0216	$p < .8834$
Interaction of Drill Materials and Ability Levels	192.5475	3	64.1825	.2053	$p < .8925$
Within Cells	27194.6222	87	312.581865		
Totals	27791.5367	94			

The calculations produced an F-ratio value of .4240 when the differences among the means of the four treatment groups were tested. That value was less than the critical value of 2.72 for 3 and 87 degrees of freedom at

the .05 level of confidence and did nto extend into the rejection region. Therefore, the null hypothesis that there is no significant difference in production-copy accuracy achievement in intermediate collegiate typewriting among the types of drill materials used was retained. It appears that equal effectiveness may be ascribed to each of the types of drill materials used in the development of production-copy accuracy.

The second hypothesis, with reference to the development of production-copy accuracy, was concerned with the effects of levels of intelligence on degrees of achievement of the students assigned to the four treatment groups. For statistical testing purposes, the hypothesis was restated in null form as follows: There is no significant difference between levels of intelligence and production-copy accuracy achievement in intermediate collegiate typewriting. The statistical results of the test justified retaining the null hypothesis.

For a review of the two-way analysis of variance test results, see Table 4.6 on page 75. The F-ratio value of .0216 for ability levels was less than the critical value of 3.86 for 1 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. The null hypothesis that there is no significant difference between levels of intelligence and production-copy achievement in intermediate collegiate typewriting was retained. It was concluded that level of intelligence was not a discriminating factor in the attainment of production-copy accuracy in this study.

The final hypothesis of the study concentrated on the effects of an interaction between types of drill materials used and levels of intelligence on achievement in production-copy accuracy. The hypothesis was

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restated in null form for statistical testing purposes as follows: There is no significant difference in production-copy accuracy achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting. The statistical test disclosed that significant interaction did not exist between types of drill materials used and levels of intelligence in influencing production-copy accuracy achievement, and the null hypothesis was retained. Table 4.6 on page 75 may be examined for a summary of the two-way analysis of variance test of interaction.

The table shows that the obtained F-ratio value of .2053 was less than the critical value of 2.72 for 3 and 87 degrees of freedom at the .05 level of confidence and did not extend into the rejection region. As a result, the null hypothesis that there is no significant difference in production-copy accuracy achievement as a result of an interaction between types of drill materials used and levels of intelligence was retained. Therefore, the test revealed that in this study an interaction of a magnitude necessary to modify production-copy accuracy achievement was not present.

Sub-Hypotheses

Twenty-four sub-hypotheses were to be tested in this study. However, as there was no significant interaction between types of drill materials used and levels of intelligence on any of the four dependent variables, none were tested. (See Appendix A for a complete listing of the 24 sub-hypotheses).

SUMMARY OF FINDINGS FROM THE STATISTICAL ANALYSIS OF THE DATA

Of the 12 major research hypotheses included in this study, only two were accepted. The following items are a summary of the statistical findings:

1. There was a significant difference in straight-copy speed achievement in intermediate collegiate typewriting among the types of drill materials used. The Scheffe' post hoc procedures revealed that the treatments which were responsible for or contributed to the acceptance of the research hypothesis were Group I (computerized drill books) and Group IV (no drills). The significant difference was found to exist in favor of Group IV (no drills).

2. There was no significant difference in straight-copy speed achievement between levels of intelligence in intermediate collegiate typewriting.

3. There was no significant difference in straight-copy speed achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting.

4. There was no significant difference in production-copy speed achievement in intermediate collegiate typewriting among the types of drill materials used.

5. There was a significant difference in production-copy speed achievement between levels of intelligence in intermediate collegiate typewriting. As there were only two levels of intelligence included in this study, there was no need to employ the Scheffe' post hoc procedures to determine which pair of means was responsible for or

contributed to the acceptance of the research hypothesis. A simple observation of the mean production-copy speed gains revealed that the significant difference was in favor of the lower-ability group.

6. There was no significant difference in production-copy speed achievement as a result of an interaction between types of drill materials used in the study and levels of intelligence in intermediate collegiate typewriting.

7. There was no significant difference in straight-copy accuracy achievement in intermediate collegiate typewriting among the types of drill materials used.

8. There was no significant difference in straight-copy accuracy achievement between levels of intelligence in intermediate collegiate typewriting.

9. There was no significant difference in straight-copy accuracy achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting.

10. There was no significant difference in production-copy accuracy achievement in intermediate collegiate typewriting among the types of drill materials used.

11. There was no significant difference in production-copy accuracy achievement between levels of intelligence in intermediate collegiate typewriting.

12. There was no significant difference in production-copy accuracy achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting.

II. NON-STATISTICAL ANALYSIS OF THE DATA

This section of the chapter presents a non-statistical discussion of the data generated by the procedures of the study.

Analysis of the data on ability levels

The mental abilities of the 95 students who participated in this study ranged from 70 to 120 as measured by the results of an administration of the Otis Quick-Scoring Mental Ability Test. The weighted mean mental ability scores for the students who were assigned to the four treatment groups may be examined in Table 4.7.

TABLE 4.7

MEAN MENTAL ABILITY SCORES OF THE STUDENTS ASSIGNED TO THE FOUR TREATMENT GROUPS

Treatment Groups	Upper Ability	Number	Lower Ability	Number	Group Means	Group Totals
I. Computerized Drill Books	96.00	9	87.33	15	90.58	24
II. Magazine Drills	101.77	13	83.10	10	93.65	23
III. Textbook Drills	97.38	8	83.07	15	88.04	23
IV. No Drills	98.18	17	82.88	8	90.53	25
Group Means	98.62		84.37		91.42	
Group Totals		47		48		95

The nine upper-ability students who were assigned to Group I (computerized drill books) possessed a mean mental ability of 96.00, the 15

lower-ability students who were assigned to Group I possessed a mean mental ability of 87.33, and the mean mental ability of the 24 students assigned to Group I combined was 90.58. The mean mental ability of the 13 students classified as upper ability who were exposed to the magazine drills treatment, Group II, was 101.77 while the mean mental ability of the ten lower-ability students exposed to the same treatment was 83.10. The mean mental ability of the magazines group combined was 93.65. The upper-ability students who typed from the textbook drills during the course of the experiment had a mean mental ability of 97.38, and the lower-ability students who typed from the textbook drills had a mean mental ability of 83.07. The mean mental ability of the total group of 23 textbook drills students was 88.04. The 17 upper-ability students who typed no drills, Group IV, had a mean mental ability of 98.18, the eight lower-ability students who typed no drills had a mean mental ability of 82.88, and the combined mental ability mean for the no drills students was 90.53. The combined group of 47 upper-ability students who were assigned to the four treatment groups had a mean mental ability of 98.62, the 48 lower-ability students had a mean mental ability of 84.37, and the combined mean mental ability of the total group of 95 students was 91.42.

The upper-ability students assigned to the magazine drills group had the highest mean mental ability of 101.77 while the lowest mean for the upper-ability students was 96.00. This group was assigned to the computerized drill book treatment. Of the lower-ability students, the group possessing the lowest mean mental ability score of 82.88 was assigned to the no drills group, and the lower-ability group possessing the highest mean mental ability of 87.33 was assigned to the computerized drill book treatment. For the combined group of upper-ability students and the

lower-ability students, the highest mean mental ability was 93.65, and the group was assigned to the magazine drills treatment. The lowest mean mental ability for the combined group of upper-ability students and lower-ability students was 88.04, and the group was assigned to the textbook drills treatment.

Analysis of data for pre-test and post-test straight-copy speed

Table 4.8, which follows, presents a summary of the pre-test and post-test data relative to straight-copy speed for the four treatment groups.

TABLE 4.8

MEAN STRAIGHT-COPY SPEED SCORES FOR PRE-TEST AND POST-TEST RESULTS, MEAN SPEED GAIN FOR UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS, AND MEAN DIFFERENCE BETWEEN SPEED GAINS FOR THE COMBINED GROUPS

Treatment Groups	Mean Pre-Test Speed	Mean Post-Test Speed	Mean Speed Gain	Mean Difference in Speed Gains for Combined Groups
I. Computerized Drill Books				
Upper Ability	56.89	58.56	1.67	
Lower Ability	52.00	54.87	2.87	1.20
II. Magazine Drills				
Upper Ability	56.85	58.85	2.00	
Lower Ability	46.80	50.70	3.90	1.90
III. Textbook Drills				
Upper Ability	46.25	49.75	3.50	
Lower Ability	48.20	53.00	4.80	1.30
IV. No Drills				
Upper Ability	52.41	58.47	6.06	
Lower Ability	51.50	57.00	5.50	.56

The Group I (computerized drill books) upper-ability students attained a mean score of 56.89 on the straight-copy pre-test and 58.56 on the straight-copy post-test. These scores represented a mean gain in straight-copy speed of 1.67 gross words per minute. The Group I lower-ability students attained a mean score of 52.00 on the straight-copy pre-test and a mean score of 54.87 on the straight-copy post-test which denotes a mean straight-copy speed gain of 2.87 gross words per minute. The mean difference between the performances of the two groups was 1.20 gross words per minute in favor of the lower-ability students.

The upper-ability students who typed from magazines, Group II, achieved a mean straight-copy speed of 56.85 on the pre-test and a mean speed of 58.85 on the straight-copy post-test. The mean difference between the two test scores for the upper-ability students was 2.00 gross words per minute. The lower-ability students achieved a mean straight-copy speed of 46.80 and a mean post-test straight-copy speed of 50.70. This group gained a mean of 3.90 gross words per minute. The lower-ability group gained a mean of 1.90 gross words per minute more than did the upper-ability students.

The students assigned to the textbook drills treatment, Group III, who were classified as upper ability reached a mean speed of 46.25 on the straight-copy pre-test and a mean speed of 49.75 on the straight-copy post-test. This group realized a mean gain of 3.50 gross words per minute. The students classified as lower ability reached a mean speed of 48.20 on the straight-copy pre-test and a mean speed of 53.00 on the straight-copy post-test. This group realized a mean gain of 4.80 gross words per minute and a mean difference of 1.30 gross words per minute more than did the upper-ability students.

The no drills students, Group IV, in the upper-ability category acquired a mean of 52.41 on the straight-copy pre-test, a mean speed of 58.47 on the straight-copy post-test, and effected a mean gain of 6.06 gross words per minute. The lower-ability students acquired a mean speed of 51.50 on the straight-copy pre-test and a mean speed of 57.00 on the straight-copy post-test. Their mean gain was 5.50 gross words per minute. These scores revealed that .56 gross words per minute less were achieved by the lower-ability students than were achieved by the upper-ability group. Table 4.9 reveals the mean gains in speed for each of the combined treatment groups.

TABLE 4.9

MEAN STRAIGHT-COPY SPEED GAINS FOR THE COMBINED GROUPS OF UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS IN THE FOUR TREATMENT GROUPS

Treatment Groups	Mean Speed Gain	Mean Gain for Combined Groups
I. Computerized Drill Books		
Upper Ability	1.67	
Lower Ability	2.87	2.42
II. Magazine Drills		
Upper Ability	2.20	
Lower Ability	3.90	2.83
III. Textbook Drills		
Upper Ability	3.50	
Lower Ability	4.80	4.35
IV. No Drills		
Upper Ability	6.06	
Lower Ability	5.50	5.88

The mean gain in speed for Group I (computerized drill books) combined was 2.42, 2.83 for Group III (magazine drills) combined, 4.35 for

Group II (textbook drills) combined, and 5.88 for Group IV (no drills) combined. Even though all groups gained in straight-copy speed, the least effective treatment for the upper-ability students, the lower-ability students, and the combined group appeared to be the computerized drill books while the most effective treatment for the upper-ability students, the lower-ability students, and the combined group appeared to be the no drills procedure. In all instances except for the no drills procedure, the lower-ability students excelled the upper-ability students in mean straight-copy speed gains.

Analysis of the data on pre-test and post-test production speed

A condensation of the pre-test and post-test scores on production-copy speed for the four treatment groups is presented in Table 4.10.

TABLE 4.10

MEAN PRODUCTION-COPY SPEED SCORES FOR PRE-TEST AND POST-TEST RESULTS, MEAN SPEED GAIN FOR UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS, AND MEAN DIFFERENCE BETWEEN SPEED GAINS FOR THE COMBINED GROUPS

Treatment Groups	Mean Pre-Test Speed	Mean Post-Test Speed	Mean Speed Gain	Mean Difference in Speed Gains for Combined Groups
I. Computerized Drill Books				
Upper Ability	24.33	27.33	3.00	
Lower Ability	18.67	23.67	5.00	2.00
II. Magazine Drills				
Upper Ability	23.16	25.31	2.15	
Lower Ability	18.20	23.80	5.60	3.45
III. Textbook Drills				
Upper Ability	19.88	24.63	4.75	
Lower Ability	19.67	25.73	6.07	1.32
IV. No Drills				
Upper Ability	22.48	26.24	3.76	
Lower Ability	20.37	23.75	3.38	.38

The mean production speed for the upper-ability students who typed from the computerized drill books, Group I, was 24.33 gross words per minute on the pre-test; and the mean post-test production speed was 27.33 gross words per minute. The difference between the pre-test and the post-test results indicated a mean gain of 3.00 gross words per minute for the upper-ability students.

The Group I lower-ability students also achieved a mean gain in production speed. The mean pre-test production speed was 18.67 gross words per minute, and the mean post-test production speed was 23.67 gross words per minute. These scores disclosed a mean gain of 5.00 gross words per minute for the lower-ability group. A mean difference between the production speed of the upper-ability students and the lower-ability students of 2.00 gross words per minute was in support of the performance of the lower-ability students.

The upper-ability students of Group II, magazine drills, succeeded in surpassing their mean pre-test score by 2.15 gross words per minute. The pre-test measurement was 23.16 gross words per minute and the post-test measurement was 25.31 gross words per minute.

The lower-ability students also exceeded their pre-test performance by a mean score of 5.60 gross words per minute. The mean pre-test score was 18.20 gross words per minute and the mean post-test score was 23.80 gross words per minute. The mean difference between the increase in the production speed for the upper-ability students and the lower-ability students was 3.45 gross words per

minute, with the lower-ability students' performances exceeding that of the upper-ability students.

Students designated as upper ability who typed from the textbook drills, Group III, were able to exceed the mean score of their pre-test performance by a margin of 4.75 gross words per minute. The mean pre-test score was 19.88 gross words per minute, and the mean post-test score was 24.63 gross words per minute. The lower-ability students also progressed from their pre-test speed by 6.07 gross words per minute. Their earned pre-test speed was 19.67 gross words per minute while their mean post-test speed rose to 25.73 gross words per minute. However, the mean difference between the production speed of the upper-ability students and that of the lower-ability students was only 1.32 gross words per minute with the superior performance in favor of the lower-ability students.

Students who typed from production tasks, Group IV, in the upper-ability group progressed from 22.48 gross words per minute to 26.24 gross words per minute in production speed. The mean difference between the pre-test and the post-test scores was 3.76 gross words per minute.

The mean production speed growth for the lower-ability students was 3.38 gross words per minute. The post-test score was 20.37 gross words per minute while the post-test score was 23.75 gross words per minute. The mean production speed growth of the upper-ability group was greater than that of the lower-ability group by a score of only .38 gross words per minute.

Table 4.11 may be examined for a summary of the mean increments in production speed for each of the combined groups.

TABLE 4.11

MEAN PRODUCTION-COPY SPEED GAINS FOR THE COMBINED GROUP OF UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS IN THE FOUR TREATMENT GROUPS

Treatment Groups	Mean Speed Gain	Mean Gain for Combined Groups
I. Computerized Drill Books		
Upper Ability	3.00	
Lower Ability	5.00	4.25
II. Magazine Drills		
Upper Ability	2.15	
Lower Ability	5.60	3.65
III. Textbook Drills		
Upper Ability	4.75	
Lower Ability	6.07	5.61
IV. No Drills		
Upper Ability	3.76	
Lower Ability	3.38	3.64

The mean increment in production speed for Group I (computerized drill books) combined was 4.25 gross words per minute; for Group II (magazine drills) combined, 3.65 gross words per minute; for Group III (textbook drills) combined, 5.61 gross words per minute; and for the students in Group IV (no drills) combined, the mean increment was 3.64 gross words per minute.

Except for the lower-ability students receiving the no drills treatment, all treatments appeared to be more beneficial for the lower-ability students than for the upper-ability students in building production speed. The most advantageous treatment for building production speed for the lower-ability students appeared to be the textbook drills treatment, and the most

advantageous treatment for building production speed for the upper-ability students appeared to be the magazine drills treatment. For the lower-ability students and the combined group of upper-ability students and lower-ability students, the least effective treatment for building production speed appeared to be the no drills procedure.

Analysis of the data on pre-test and post-test straight-copy accuracy

A compilation of the data derived from the pre-test and post-test results on straight-copy accuracy may be reviewed in Table 4.12 below.

TABLE 4.12

MEAN STRAIGHT-COPY ACCURACY SCORES FOR PRE-TEST AND POST-TEST RESULTS, MEAN ACCURACY GAIN FOR UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS, AND MEAN DIFFERENCE BETWEEN GAINS FOR THE COMBINED GROUPS

Treatment Groups	Mean Pre-Test Accuracy	Mean Post-Test Accuracy	Mean Accuracy Gain	Mean Difference in Accuracy Gain
I. Computerized Drill Books				
Upper Ability	93.11%	92.55%	-.56%	
Lower Ability	92.73%	93.00%	.27%	-.29%
II. Magazine Drills				
Upper Ability	91.62%	92.00%	.38%	
Lower Ability	89.70%	92.40%	2.70%	2.32%
III. Textbook Drills				
Upper Ability	89.88%	93.13%	3.25%	
Lower Ability	88.94%	89.87%	.93%	2.32%
IV. No Drills				
Upper Ability	92.53%	92.47%	-.06%	
Lower Ability	92.25%	95.00%	2.75%	2.69%

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The level of straight-copy accuracy for the upper-ability students who were exposed to the computerized drill book treatment, Group I, was determined to be 93.11 percent when the pre-test was administered and 92.55 percent after the administration of the post-test. These scores indicated a loss of .56 percent in accuracy on straight-copy material when the study was terminated. The lower-ability students had accomplished a mean gain in accuracy of .27 percent with a pre-test accuracy score of 92.73 percent and a post-test accuracy score of 93.00 percent. The mean difference was .29 percent between the straight-copy accuracy gain of the upper-ability students and the lower-ability students.

The upper-ability students who typed paragraphs from magazines, Group II, gained in straight-copy accuracy by .38 percent. Their pre-test accuracy score was 91.62 percent and their post-test accuracy score was 92.00 percent. The lower-ability students of Group II gained 2.70 percent in accuracy which was considerably greater than the mean accuracy gain of the upper-ability students. The pre-test accuracy score for the lower-ability students was 89.70 percent and the post-test accuracy score was 92.40 percent. The mean difference between the accuracy level of the two groups was 2.32 percent in favor of the lower-ability students.

The percentage of straight-copy accuracy earned by the upper-ability students of Group III, textbook drills, on the pre-test was 89.88 percent and 93.13 percent on the post-test. This group gained in accuracy by 3.25 percent while the lower-ability students only gained .93 percent in accuracy. The lower-ability students' accuracy level was 88.94 percent when the pre-test was administered and 89.87 percent when the post-test was administered. The mean difference between the two groups' performance was 2.32 percent in favor of the upper-ability students.

The no drills group, Group IV, upper-ability students' level of straight-copy accuracy was measured to be 92.53 percent when the pre-test was administered and 92.47 percent when the post-test was administered. The mean difference between the scores revealed a decrease in straight-copy accuracy of -.06 percent while the lower-ability students realized a mean gain of 2.75 percent. The pre-test score was 92.25 percent, and the post-test score was 95.00 percent revealing a mean difference between the upper-ability students and the lower-ability students of 2.69 percent in favor of the lower-ability students.

See Table 4.13 for a digest of the mean increments in straight-copy accuracy for the four treatment groups.

TABLE 4.13

MEAN STRAIGHT-COPY ACCURACY GAINS FOR THE COMBINED GROUPS OF UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS IN THE FOUR TREATMENT GROUPS

Treatment Groups	Mean Accuracy Gain	Mean Accuracy Gain for Combined Groups
I. Computerized Drill Books		
Upper Ability	-.56%	
Lower Ability	.27%	-.42%
II. Magazine Drills		
Upper Ability	.38%	
Lower Ability	2.70%	1.39%
III. Textbook Drills		
Upper Ability	3.25%	
Lower Ability	.93%	1.74%
IV. No Drills		
Upper Ability	-.06%	
Lower Ability	2.75%	.84%

A mean decrease of .42 percent in level of straight-copy accuracy was accrued by the upper-ability students and the lower-ability students

of Group I combined. The three other treatment groups achieved gains in level of accuracy. Group II gained 1.39 percent, Group III gained 1.74 percent, and Group IV gained .84 percent in straight-copy accuracy.

Except for the upper-ability students assigned to the computerized drill books and the no drills group, all groups of students gained in straight-copy accuracy. However, the gains were very small in the cases of the lower-ability students assigned to the computerized drill books treatment, the upper-ability students assigned to the magazine drills treatment, and the lower-ability students assigned to the textbook drills treatment.

The lower-ability students assigned to the computerized drill books treatment, the lower-ability students assigned to the magazine drills treatment, and the lower-ability students assigned to the no drills treatment surpassed the mean percentage of accuracy gain of that of the upper-ability students on straight-copy material. The upper-ability students assigned to the textbook drills treatment surpassed all other groups in levels of mean accuracy gain.

The least effective treatment for building straight-copy accuracy for the upper-ability students, the lower-ability students, and the combined group of upper-ability students and lower-ability students appeared to be the computerized drill books treatment. The most effective treatment for building straight-copy accuracy for both the upper-ability students and the combined group of upper-ability students and lower-ability students appeared to be the textbook drills treatment. For the lower-ability students, the no drills treatment yielded a level of accuracy gain which was greater than for the other three treatments.

Analysis of data on pre-test and post-test production-copy accuracy

The most impressive performance by the upper-ability students was in the area of production-copy accuracy; however, there was no extreme difference between their performance and that of the lower-ability students. An observation of Table 4.14 will reveal the mean production accuracy scores based on the pre-test and the post-test results for the four groups of upper-ability students and lower-ability students.

TABLE 4.14

MEAN PRODUCTION-COPY ACCURACY SCORES FOR PRE-TEST AND POST-TEST RESULTS, MEAN ACCURACY GAIN FOR UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS, AND MEAN DIFFERENCE BETWEEN SPEED GAINS FOR THE COMBINED GROUPS

Treatment Groups	Mean Pre-Test Accuracy	Mean Post-Test Accuracy	Mean Accuracy Gain	Mean Difference in Accuracy Gain
I. Computerized Drill Books				
Upper Ability	74.22%	83.78%	9.56%	
Lower Ability	75.49%	80.93%	5.53%	4.03%
II. Magazine Drills				
Upper Ability	82.38%	88.31%	5.93%	
Lower Ability	69.10%	71.20%	2.10%	3.83%
III. Textbook Drills				
Upper Ability	78.63%	83.75%	5.12%	
Lower Ability	72.74%	81.27%	8.53%	3.41%
IV. No Drills				
Upper Ability	79.71%	83.24%	3.53%	
Lower Ability	72.50%	74.00%	1.50%	2.03%

The mean production accuracy gain for the upper-ability students exposed to the computerized drill books treatment, Group I, was 9.56 percent. The pre-test production accuracy score was 74.22 percent and the mean

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post-test accuracy score was 83.78 percent. The mean production accuracy gain for the lower-ability students was slightly less than that of the upper-ability students, 5.53 percent. The mean pre-test accuracy score for the lower-ability students was 75.49 percent and the mean post-test accuracy score was 80.93 percent. The upper-ability group differed in accuracy level from the lower-ability group by a score of 4.03 percent in favor of the upper-ability students.

The upper-ability students who received the magazine drills treatment increased their mean level of accuracy by a score of 5.93 percent. The accuracy level of the pre-test was 82.38 percent and the accuracy level of the post-test was 88.31 percent. For the lower-ability students, the size of the increase in production accuracy, 2.10 percent, was not as great as that of the upper-ability students. The pre-test accuracy level for the lower-ability group was 69.10 percent, and the post-test accuracy level was 71.20 percent. The two groups varied in level of production accuracy by a score of 3.83 percent in favor of the upper-ability group.

The upper-ability students who were included in the textbook drills treatment, Group III, earned an accuracy score of 78.63 percent on the pre-test and an accuracy score of 83.75 percent on the post-test. The mean accuracy score of this group was strengthened by a score of 5.12 percent. The lower-ability students attained a mean accuracy score of 72.74 percent on the pre-test and a mean accuracy score of 81.27 percent on the post-test. The difference between the lower-ability group's pre-test and post-test performance amounted to a mean improvement of 8.53 percent in production accuracy. The contrast between the performance of the upper-ability students and the lower-ability students was a mean score of 3.41 percent in favor of the lower-ability students.

The production accuracy level of the upper-ability students who comprised the no drills group, Group IV, was enhanced by a mean score of 3.53 percent after their exposure to this treatment. The mean pre-test score was 79.71 percent, and the mean post-test score was 83.24 percent. The lower-ability students, therefore, improved their production accuracy by a mean score of 1.50 percent. The mean pre-test measurement was 72.50 percent, and the mean post-test accuracy measurement was 74.00 percent. There was no marked degree of difference between levels of accuracy for the two groups. The upper-ability group and the lower-ability group differed in accuracy performance by a mean of 2.03 percent.

Both levels of students in all four of the treatment groups were able to improve in production accuracy. However, in some cases, the increases were not extensive. Table 4.15 summarizes these increases.

TABLE 4.15

MEAN PRODUCTION-COPY ACCURACY GAINS FOR THE COMBINED GROUPS OF UPPER-ABILITY STUDENTS AND LOWER-ABILITY STUDENTS IN THE FOUR TREATMENT GROUPS

Treatment Groups	Mean Accuracy Gain	Mean Gain for Combined Groups
I. Computerized Drill Books		
Upper Ability	9.56%	
Lower Ability	5.53%	7.04%
II. Magazine Drills		
Upper Ability	5.93%	
Lower Ability	2.10%	4.26%
III. Textbook Drills		
Upper Ability	5.12%	
Lower Ability	8.53%	7.34%
IV. No Drills		
Upper Ability	3.53%	
Lower Ability	1.50%	2.88%

The mean gain in production accuracy for Group I (computerized drill books) combined was 7.04 percent, the mean gain for Group II (magazine drills) combined was 4.26 percent, the mean gain for Group III (textbook drills) combined was 7.34 percent, and the mean gain for Group IV (no drills) combined was 2.88 percent. None of the gains increased the accuracy levels to a mean of at least 90 percent for any of the treatment groups. The highest mean accuracy level achieved was 88.31 percent by the upper-ability students assigned to the magazine drills treatment.

The computerized drill books appeared to be superior to all other types of treatments in improving the production accuracy of the upper-ability students and for the combined group of upper-ability students and lower-ability students. The least beneficial treatment in producing greater production accuracy for the lower-ability students and for the combined group of upper-ability students and lower-ability students appeared to be the no drills treatment. The most effective treatment for building production accuracy for the lower-ability students appeared to be the textbook drills treatment. In all instances except for the textbook drills group, the upper-ability students rated higher in production accuracy gain than did the lower-ability students.

SUMMARY OF NON-STATISTICAL ANALYSIS OF THE DATA

This section of the chapter presents a summary of the non-statistical analysis of the data generated by the procedures of the study.

Ability levels

The mental abilities of the 95 subjects who participated in this typewriting experiment ranged from 70 to 120 as measured by the results

of an administration of the Otis Quick-Scoring Mental Ability Test. The test was utilized as a means of classifying students into upper-ability and lower-ability categories. After mental ability scores had been arranged in descending order, the first 47 scores were designated as upper ability; and the remaining 48 scores were designated as lower ability. Consequently, three mental ability scores of 90 were assigned to the upper-ability group and five mental ability scores of 90 were assigned to the lower-ability group. Thus, the two groups were not mutually exclusive.

Of the 24 students randomly assigned to Group I (computerized drill books), nine were classified as upper ability and 15 were classified as lower ability. Thirteen of the 23 students assigned to Group II (magazine drills) were classified as upper ability and ten were classified as lower ability. Eight upper-ability students and 15 lower-ability students comprised Group III (textbook drills). Seventeen students in Group IV (no drills) were classified as upper ability and eight were classified as lower ability of a total of 25 students.

The mean mental ability of the four groups of upper-ability students ranged from 96.00 to 101.77. Group I (computerized drill books) registered a mean of 96.00, Group II (magazine drills) registered a mean of 101.77, Group III (textbook drills) registered a mean of 97.38 and Group IV (no drills) registered a mean of 98.18. For the four combined groups of upper-ability students, the mean mental ability score was 98.62

For the lower-ability students, the mean mental ability score of the four treatment groups ranged from 82.88 to 87.33. A mean score of 87.33 was recorded for Group I (computerized drill books), 83.10 was

recorded for Group II (magazine drills), 83.07 was recorded for Group III (textbook drills), and 82.88 was recorded for Group IV (no drills). The mental ability score for the lower-ability students in the four treatment groups combined was 84.37.

The group mean for the upper-ability students and the lower-ability students combined in each treatment group was 90.58 for Group I (computerized drill books), 93.65 for Group II (magazine drills), 88.04 for Group III (textbook drills), and 90.53 for Group IV (no drills). The mean mental ability of all 95 students combined was 91.42.

The results of the one-way analysis of variance test indicated that the mental abilities of the combined group of upper-ability students and the combined group of lower-ability students were significantly different at the .05 level of confidence at the outset of the study. (See Table 3.1 on page 55 for a summary of the one-way analysis of variance test).

Straight-copy speed

When a comparison of straight-copy pre-test and post-test mean scores was made, it was determined that all treatment groups had achieved increments in straight-copy speed. The gains in straight-copy speed ranged from 1.67 gross words per minute for the upper-ability students assigned to Group I (computerized drill books) to 6.06 gross words per minute for the upper-ability students assigned to Group IV (no drills). Except for the upper-ability students assigned to Group IV, the lower-ability students who were exposed to the other three treatments excelled the performance of the upper-ability students in mean straight-copy speed gains.

The most effective treatment for building straight-copy speed for the upper-ability students appeared to be the no drills treatment while the least effective treatment appeared to be the computerized drill books. The most effective treatment for building straight-copy speed for the lower-ability students appeared to be the no drills treatment while the least effective appeared to be the computerized drill books. The most effective treatment for building straight-copy speed for the combined group of upper-ability students and lower-ability students appeared to be the no drills treatment, and the computerized drill book appeared to be the least effective.

Straight-copy accuracy

All treatment groups except the upper-ability students assigned to Group I (computerized drill books) and the upper-ability students assigned to Group IV (no drills) achieved an increase in straight-copy accuracy during the course of the experiment. The accuracy percentage scores ranged from -.06 percent for the Group IV (no drills) upper-ability students to 3.25 percent for the Group III (textbook drills) upper-ability students. All lower-ability students, with the exception of Group III (textbook drills) realized a greater gain in straight-copy accuracy than did the upper-ability students.

The most beneficial treatment for facilitating straight-copy accuracy for the upper-ability students seemed to be the textbook drills treatment while the least beneficial treatment seemed to be the computerized drill books. For the lower-ability students, the most productive treatment for facilitating straight-copy accuracy seemed to be the no drills procedure; and the least productive seemed to be the

computerized drill books. The textbook drills treatment seemed to promote greater gains in straight-copy accuracy for the combined group of upper-ability students and lower-ability students than did the other treatments while the computerized drill books seemed to contribute little toward the development of accuracy in straight-copy typewriting.

Production speed

All four of the treatment groups realized a mean production speed gain regardless of the treatment received during the course of the experiment. The gains of the students ranged from a low of 2.15 gross words per minute for the upper-ability students assigned to Group II (magazine drills) to a high of 6.07 gross words per minute for the lower-ability students who were assigned to Group III (textbook drills). Except for the upper-ability students assigned to Group IV (no drills), the production speed performance of the lower-ability students was superior to that of the upper-ability students.

The mean production speed gain scores suggest that the most efficient procedure for building production speed for the upper-ability students was the textbook drills treatment. The lower-ability students who received the textbook drills treatment attained greater production speed gains than did the lower-ability students in the other treatment groups. The least gains in mean production speed was achieved by the lower-ability students in the no drills group. For the combined group of upper-ability students and lower-ability students the most advantageous treatment appeared to be the textbook drills while the least effective of the four treatments appeared to be the no drills treatment.

Production accuracy

Post-test scores revealed that all groups developed higher levels of mean production accuracy by the end of the experiment. The increases in production accuracy ranged from 1.50 percent for the lower-ability students assigned to the no drills treatment to 9.56 percent for the upper-ability students assigned to the computerized drill books treatment. With the exception of the lower-ability students assigned to the textbook drills treatment, the performance of the upper-ability students exceeded that of the lower-ability students.

The treatment most conducive to the development of production accuracy for the upper-ability students seemed to be the computerized drill books treatment, and the least conducive appeared to be the no drills treatment. The most valuable treatment for developing production accuracy for the lower-ability students appeared to be the textbook drills treatment while the least valuable appeared to be the no drills treatment. The combined group of upper-ability students and lower-ability students were able to obtain greater returns in production accuracy by exposure to the computerized drill books treatment and the least returns were gained by exposure to the no drills treatment.

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CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

I. SUMMARY

The problem of this study was to attempt to determine the effects of levels of intelligence and types of drill materials on achievement in intermediate collegiate typewriting. Achievement was measured in terms of straight-copy speed and accuracy on three-minute timed writings and in terms of production-copy speed and accuracy on 30-minute typewriting tasks.

The purpose of this study was to attempt to determine whether typewriting instructors should be concerned about the levels of intelligence of students who enroll in typewriting classes and the types of drill practice given as it relates to organization and presentation of units of instruction.

If levels of intelligence and types of drill practice do, in fact, influence achievement of speed and/or accuracy on straight-copy timed writings and/or satisfactory performance on production copy, then it would be beneficial for the typewriting instructor to have some knowledge of the range of each student's capabilities as well as the type of drill practice which is likely to facilitate achievement. This knowledge could serve as a basis for the determination of the areas of content emphasis and for the more efficient individualization of learning activities. These activities could contribute to the optimum development of those skills and knowledges needed to perform competently upon the completion of the typewriting course.

If, on the other hand, levels of intelligence and types of drill work do not affect performance on either straight-copy timed writings or production typewriting tasks, typewriting instructors would have some rationale for gearing their teaching activities toward other areas which might facilitate achievement in intermediate collegiate typewriting.

This study was important because it involved the use of two types of drill materials which have not been utilized in scholarly investigations prior to this. One type of drill material used which fits this category was a computerized drill book which was composed of copy material specifically designed to analyze the student's typewriting errors. This drill book was based largely upon a research study conducted by David H. Weaver (see Chapter III). Depending upon the number of errors made on the first timed writing, the student is directed by instructions contained in the book to type a remedial drill which is geared either toward developing greater speed or greater accuracy. The title of the book is Selective Practice Typing Drills and was published in 1974. The book was coauthored by Alan C. Lloyd, Robert P. Poland, Fred E. Winger, John L. Rowe, and William D. Griffith. The second type of drill material used was ordinary English prose, such as is to be found in magazines and books. In this study, magazines were used.

A pilot study which was similar to this investigation was conducted at Michigan State University located in East Lansing, Michigan, during the 1975 winter term in which two second-quarter typewriting classes were used as subjects. Half of each class was randomly assigned to one of the two treatment groups, one of which involved typing from the computerized drill book, Selective Practice Typing Drills, and one

of which typed from Saturday Review World magazines for the first 15 minutes of each class period. The study was conducted for one quarter and revealed a significant difference in straight-copy speed gains between the two groups in favor of the students assigned to the magazine drills group.

The hypotheses tested in this study which were restated for statistical analysis in null form were as follows:

1. Speed in intermediate collegiate typewriting on straight-copy material will be affected by types of drill materials used.

2. Speed in intermediate collegiate typewriting on straight-copy material will be affected by levels of intelligence.

3. Speed in intermediate collegiate typewriting on straight-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

4. Speed in intermediate collegiate typewriting on production-copy material will be affected by types of drill materials used.

5. Speed in intermediate collegiate typewriting on production-copy material will be affected by levels of intelligence.

6. Speed in intermediate collegiate typewriting on production-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

7. Accuracy in intermediate collegiate typewriting on straight-copy material will be affected by types of drill materials used.

8. Accuracy in intermediate collegiate typewriting on straight-copy material will be affected by levels of intelligence.

9. Accuracy in intermediate collegiate typewriting on straight-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

10. Accuracy in intermediate collegiate typewriting on production-copy material will be affected by types of drill materials used.

11. Accuracy in intermediate collegiate typewriting on production-copy material will be affected by levels of intelligence.

12. Accuracy in intermediate collegiate typewriting on production-copy material will be affected by an interaction between types of drill materials used and levels of intelligence.

In addition, 24 subhypotheses were postulated concerning the possible interactions between each type of drill material and each level of intelligence regarding straight-copy speed, straight-copy accuracy, production-copy speed, and production-copy accuracy. For example:

1. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment I (computerized drill books).

2. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment II (magazine drills). (See Appendix A for the entire list of the 24 subhypotheses.)

The students who participated in the study were students enrolled in five intact classes in intermediate collegiate typewriting. Two of the classes were students who were enrolled at Alcorn State University in Lorman, Mississippi; one of the classes was made up of students who were enrolled at Jackson State University in Jackson, Mississippi; and two of the classes were students who were enrolled at Mississippi Valley State University in Itta Bena, Mississippi.

The results of an administration of the Otis Quick-Scoring Mental Ability Test were used as a means of grouping students into upper-ability and lower-ability categories. A typewriting pre-test consisting of two, three-minute timed writings and a production test was administered prior to the initiation of the study in order to determine the typewriting proficiency of the students. The production section of the pre-test consisted of a manuscript, a news release containing rough-draft marks, and a letter containing rough-draft marks and tabulations. The test was timed for 30 minutes and contained a total of 1,097 words (see Appendix C for a copy of the pre-test).

Upon the termination of the study, a post-test, consisting of the same three-minute timed writings and a production test of different copy but of the same type of typewriting tasks, was administered. The results were used to measure the effects of exposure to the four experimental treatments. The test was timed for 30 minutes and contained a total of 1,186 words (see Appendix D for a copy of the post-test). All students were tested on identical material for validity of results.

For analyses purposes, only the better of the two, three-minute timed writings were used which were included in both the pre-test and the post-test. The students' pre-test and post-test scores were compared in order to derive a measure of their levels of achievement on straight-copy speed and accuracy and on production-copy speed and accuracy as a result of exposure to one of the four experimental treatments. The two-way analysis of variance technique was used to determine whether significant differences existed between any of the four treatment groups. When instances of significance occurred, the Scheffe' post hoc

procedure was used to ascertain which pair of means contributed to or was responsible for the rejection of the null hypothesis.

Approximately one-fourth of the students from each of the classes at each university was randomly assigned to one of the four treatment groups by drawing a numbered slip of paper from a box. Group I typed drills from the computerized drill book entitled Selective Practice Typing Drills, Group II typed paragraphs which they selected themselves from Ebony magazines, Group III typed preparatory drills from the textbooks which were currently being used at their respective universities, and Group IV did not type warm-up drills. Group IV proceeded to type those production tasks which were assigned by their instructors.

Fifteen minutes of each class day was devoted to the experimental drill practice and one, three-minute timed writing. Each treatment group, with the exception of Group IV, typed and quickly scored a three-minute timed writing at the beginning of each class period; and the remainder of the 15 minutes was devoted to additional drill work. After the 15 minutes of drill practice was completed, the remainder of the class period was conducted according to the discretion of the typewriting instructors.

SUMMARY OF STATISTICAL FINDINGS

Of the 12 major research hypotheses included in the study, only two were accepted:

1. There was a significant difference in straight-copy speed achievement in intermediate collegiate typewriting among the types of drill materials used. The Scheffé post hoc procedures revealed

that the treatment means which were responsible for or contributed to the acceptance of the research hypothesis were generated by Group I (computerized drill books) and Group IV (no drills). The significant difference was found to exist favoring Group IV.

2. There was a significant difference in production-copy speed achievement between levels of intelligence in intermediate collegiate typewriting. As there were only two levels of intelligence included in the study, it was not necessary to employ the Scheffé post hoc procedures to determine which pair of means were responsible for or contributed to the acceptance of the research hypothesis. A simple observation of mean production-copy speed gains revealed that the significant difference was in favor of the lower-ability group. (See Table 4.4 on page 70).

No significant differences were found regarding any of the following hypotheses:

1. There was no significant difference in straight-copy speed achievement between levels of intelligence in intermediate collegiate typewriting.

2. There was no significant difference in straight-copy speed achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting.

3. There was no significant difference in production-copy speed achievement in intermediate collegiate typewriting among the types of drill materials used.

4. There was no significant difference in production-copy speed achievement as a result of an interaction between types of drill

materials used and levels of intelligence in intermediate collegiate typewriting.

5. There was no significant difference in straight-copy accuracy achievement in intermediate collegiate typewriting among the types of drill materials used.

6. There was no significant difference in straight-copy accuracy achievement between levels of intelligence in intermediate collegiate typewriting.

7. There was no significant difference in straight-copy accuracy achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting.

8. There was no significant difference in production-copy accuracy achievement in intermediate collegiate typewriting among the types of drill materials used.

9. There was no significant difference in production-copy accuracy achievement between levels of intelligence in intermediate collegiate typewriting.

10. There was no significant difference in production-copy accuracy achievement as a result of an interaction between types of drill materials used and levels of intelligence in intermediate collegiate typewriting.*

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*See Chapter IV for a more detailed discussion of the 12 hypotheses included in the study.

SUMMARY OF NON-STATISTICAL FINDINGS

A non-statistical analysis of the data was made in addition to the statistical analysis. The following are a summary of the non-statistical findings:

1. All treatment groups achieved mean increments in straight-copy speed. The gains ranged from 1.67 gross words per minute for the upper-ability students assigned to Group I (computerized drill books) to 5.88 gross words per minute for the upper-ability students assigned to Group IV (no drills). Except for the upper-ability students assigned to Group IV, the lower-ability students who were exposed to the other three treatments excelled the performance of the upper-ability students in mean straight-copy speed gains. Table 5.1 presents a summary of the effectiveness of the four treatments in building straight-copy speed.

TABLE 5.1

EFFECTIVENESS OF TREATMENTS IN DEVELOPING STRAIGHT-COPY SPEED FOR UPPER-ABILITY STUDENTS, FOR LOWER-ABILITY STUDENTS, AND FOR COMBINED GROUPS

Groups	Most Effective Treatment	Least Effective Treatment
Upper-Ability Students	No Drills	Computerized Drill Books
Lower-Ability Students	No Drills	Computerized Drill Books
Combined Groups	No Drills	Computerized Drill Books

The most effective treatment for developing gains in straight-copy speed for the upper-ability students appeared to be the no drills treatment while the least effective treatment appeared to be the computerized drill books. The most effective treatment for developing gains in speed

on straight-copy material for the lower-ability students appeared to be the no drills treatment, and the least effective treatment appeared to be the computerized drill books. For the combined group of upper-ability students and the lower-ability students, the most effective treatment for developing straight-copy speed appeared to be the no drills treatment; and the least effective appeared to be the computerized drill books.

2. All treatment groups realized a mean gain in production-copy speed regardless of the treatment received during the course of the experiment. The gains ranged from 2.15 for the Group II (magazine drills) upper-ability students to 6.07 for the Group III (textbook drills) lower-ability students. Except for the upper-ability students assigned to Group IV (no drills), the production speed gains of the lower-ability students were superior to that of the upper-ability students. Table 5.2 gives a summary of the effectiveness of the treatments in building production speed.

TABLE 5.2

EFFECTIVENESS OF TREATMENTS IN DEVELOPING PRODUCTION-COPY SPEED FOR UPPER-ABILITY STUDENTS, FOR LOWER-ABILITY STUDENTS, AND FOR COMBINED GROUPS

Groups	Most Effective Treatment	Least Effective Treatment
Upper-Ability Students	Textbook Drills	Magazine Drills
Lower-Ability Students	Textbook Drills	No Drills
Combined Groups	Textbook Drills	No Drills

The most efficient procedure for building production speed for the upper-ability students was the textbook drills treatment, and the least effective was the magazine drills treatment. The most efficient procedure for the lower-ability students for building production speed was

the textbook drills and the least effective was the no drills treatment. For the combined group of upper-ability students and the lower-ability students, the most advantageous treatment for building production speed appeared to be the textbook drills while the least effective treatment appeared to be the no drills treatment.

3. Except for the upper-ability students assigned to Group I (computerized drill books) and the upper-ability students assigned to Group IV (no drills), all treatment groups achieved a mean increase in straight-copy accuracy. All lower-ability students, with the exception of Group III (textbook drills), realized a greater gain in straight-copy accuracy than did the upper-ability students. However, the gains were not significant. The accuracy scores ranged from -.06 percent for the Group IV (no drills) upper-ability students to 3.25 percent for the Group III (textbook drills) upper-ability students. Table 5.3 below gives a summary of the effectiveness of the treatments in building straight-copy accuracy.

TABLE 5.3

EFFECTIVENESS OF TREATMENTS IN DEVELOPING STRAIGHT-COPY ACCURACY FOR UPPER-ABILITY STUDENTS, FOR LOWER-ABILITY STUDENTS, AND FOR COMBINED GROUPS

Groups	Most Effective Treatment	Least Effective Treatment
Upper-Ability Students	Textbook Drills	Computerized Drill Books
Lower-Ability Students	No Drills	Computerized Drill Books
Combined Groups	Textbook Drills	Computerized Drill Books

The most beneficial treatment for facilitating straight-copy accuracy for the upper-ability students seemed to be the textbook drills while the least beneficial treatment seemed to be the computerized drill

books. For the lower-ability students, the most productive treatment for facilitating straight-copy accuracy seemed to be the no drills procedure; and the least effective seemed to be the computerized drill books. The textbook drills treatment seemed to promote greater gains in straight-copy accuracy for the combined group of upper-ability students and the lower-ability students than did the other treatments while the computerized drill books seemed to contribute little toward the development of straight-copy accuracy.

4. All groups achieved higher mean levels of production accuracy by the end of the experiment. The mean increases ranged from 1.50 percent for the Group IV (no drills) lower-ability students to 9.56 percent for the Group I (computerized drill books) upper-ability students. With the exception of the lower-ability students who were assigned to the textbook drills treatment, the accuracy gains of the upper-ability students exceeded those of the lower-ability students. The gains were not significant, however. Table 5.4 presents a summary of the effectiveness of the treatments in developing production-copy accuracy.

TABLE 5.4

EFFECTIVENESS OF TREATMENTS IN DEVELOPING PRODUCTION-COPY ACCURACY FOR UPPER-ABILITY STUDENTS, FOR LOWER-ABILITY STUDENTS AND FOR COMBINED GROUPS

Groups	Most Effective Treatment	Least Effective Treatment
Upper-Ability Students	Computerized Drill Books	No Drills
Lower-Ability Students	Textbook Drills	No Drills
Combined Groups	Computerized Drill Books	No Drills

The treatment most conducive to the development of production accuracy for the upper-ability students seemed to be the computerized drill books treatment, and the least effective appeared to be the no drills treatment. The most valuable treatment for the lower-ability students in developing production accuracy appeared to be the textbook drills while the least valuable appeared to be the no drills treatment. The combined group of upper-ability students and lower-ability students were able to obtain greater gains in production accuracy by exposure to the computerized drill books treatment and the least gains by exposure to the no drills treatment.

II. CONCLUSIONS

The conclusions derived from an analysis of the findings of this study were summarized as follows:

1. Drill practice during the second semester of intermediate collegiate typewriting is of little value in producing meaningful gains in straight-copy speed and accuracy and in producing meaningful gains in production-copy speed and accuracy. However, the benefits which can be derived from emphasizing the typing of drills at the intermediate level of instruction are more in favor of the lower-ability students than the upper-ability students.

2. Levels of intelligence, as categorized in this study, do not play an important role in achievement in intermediate collegiate typewriting. However, since all treatment groups acquired mean gains in straight-copy speed and accuracy and production-copy speed and accuracy,

the amount of time in which a student engages in typewriting practice facilitates achievement.

III. IMPLICATIONS

The implications which appear to be warranted as a result of the findings of this study are as follows:

1. Although levels of intelligence, as categorized in this study, do not play an important role in achievement in intermediate collegiate typewriting, the lower-level students did achieve higher mean gains than did the upper-level students except in straight-copy speed and production-copy speed for the no drills group, straight-copy accuracy for the textbook drills group, and all groups in production accuracy except for the lower-level textbook drills group. Therefore, an implication might be that drill work should vary inversely with intelligence levels in the typewriting classes. That is, the more intelligent the student, the less drill work he or she should be required to practice.

2. Although there are many and varied typewriting teaching materials and techniques available which have been carefully and thoroughly devised, the diverse findings revealed in the review of literature, together with the findings of this study, seem to imply that it is not yet known what techniques work best for which student in the teaching and learning of typewriting.

IV. RECOMMENDATIONS

The following recommendations were made on the basis of the findings of this study:

1. A replication or replications of this study should be conducted

for an extended period of time to cover one semester or one full school year to clarify, support, or refute its findings.

2. A study or studies should be conducted to attempt to determine the feasibility of building straight-copy speed using the no-drills approach.

3. A study or studies should be conducted to further isolate the effects of levels of intelligence on achievement in straight-copy speed and accuracy and production-copy speed and accuracy.

4. A study or studies should be conducted to attempt to determine the effects of amount of time devoted to drill practice on straight-copy speed and accuracy achievement and on production-copy speed and accuracy.

5. A study or studies should be conducted on the high-school level to attempt to determine if the results would differ from those of this study.

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APPENDIX A

SUB-HYPOTHESES

1. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment I (computerized drill books).

2. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment II (magazine drills).

3. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment III (textbook drills).

4. There will be a significant difference in speed on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment IV (no drills).

5. There will be a significant difference in speed on straight-copy timed writings among students classified as lower ability who will be exposed to Treatments I, II, III, and IV.

6. There will be a significant difference in speed on straight-copy timed writings among students classified as lower ability who will be exposed to Treatments I, II, III, and IV.

7. There will be a significant difference in speed on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment I (computerized drill books).

8. There will be a significant difference in speed on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment II (magazine drills).

9. There will be a significant difference in speed on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment III (textbook drills).

10. There will be a significant difference in speed on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment IV (no drills).

11. There will be a significant difference in speed on production copy among students classified as upper ability who will be exposed to Treatments I, II, III, and IV.

12. There will be a significant difference in speed on production copy among students classified as lower ability who will be exposed to Treatments I, II, III, and IV.

13. There will be a significant difference in accuracy on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment I (computerized drill books).

14. There will be a significant difference in accuracy on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment II (magazine drills).

15. There will be a significant difference in accuracy on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment III (textbook drills).

16. There will be a significant difference in accuracy on straight-copy timed writings between students classified as upper ability and students classified as lower ability who will be exposed to Treatment IV (no drills).

17. There will be a significant difference in accuracy on straight-copy timed writings among students classified as upper ability who will be exposed to Treatments I, II, III, and IV.

18. There will be a significant difference in accuracy on straight-copy timed writings among students classified as lower ability who will be exposed to Treatments I, II, III, and IV.

19. There will be a significant difference in accuracy on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment I (computerized drill books).

20. There will be a significant difference in accuracy on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment II (magazine drills).

21. There will be a significant difference in accuracy on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment III (textbook drills).

22. There will be a significant difference in accuracy on production copy between students classified as upper ability and students classified as lower ability who will be exposed to Treatment IV (no drills).

23. There will be a significant difference in accuracy on production copy among students classified as upper ability who will be exposed to Treatments I, II, III, and IV.

24. There will be a significant difference in accuracy on production copy among students classified as lower ability who will be exposed to Treatments I, II, III, and IV.

APPENDIX B

LOWER-ABILITY STUDENTS' RAW SCORES GENERATED BY THE OTIS QUICK-SCORING MENTAL ABILITY TEST

Student Numbers	Mental Ability Scores
52	90
53	90
54	90
55	90
68	90
56	89
57	89
69	89
70	89
74	89
75	89
94	89
58	88
59	88
60	88
71	88
7	87
8	87
76	87
77	87
9	86
10	86
20	86
21	86
22	86
78	86
95	86
23	85
31	85
79	85
80	85
81	85
82	85
19	84
11	82
45	82
47	82
32	81
12	80
48	80
33	79
46	76
24	75
34	75
35	75
36	73
49	71
25	70

N = 48

UPPER-ABILITY STUDENTS' RAW SCORES GENERATED BY THE OTIS QUICK-SCORING MENTAL ABILITY TEST

Student Numbers	Mental Ability Scores
13	120
1	117
14	107
37	107
38	106
39	106
15	105
16	105
17	104
67	104
18	103
40	103
61	103
2	102
26	102
27	101
28	100
41	100
42	100
62	100
63	99
83	99
84	99
85	98
64	97
86	97
87	97
3	96
4	96
29	96
88	95
65	94
89	94
90	94
50	93
66	93
5	92
30	92
72	92
73	92
91	92
6	91
92	91
93	91
43	90
44	90
51	90

N = 47

APPENDIX C

In a day and age when most of our men of science are looking far beyond the skies into the heavens of space, it is interesting to know that other men of science are looking in the opposite direction, down into the earth itself, to see what our world is made of. Men already know more about the space that surrounds our globe than they do about what is in it. We know how to hurtle a mortal hundreds of miles into space; but the deepest hole we have made in the earth is one oil well five miles deep, and the deepest mining shaft is only two miles deep.

There is much speculation about the nature of the globe on which we live, most of it based on where the echoes of earthquakes show up, plus what has been learned from the study of volcanoes, all of which, taken together, is something less than what you could learn about the elephant by studying a flea bite on the tip of its tail. We know the earth is not a solid chunk of rock, for example, because quake echoes do not run through the globe the way they would through a solid rock. We know, similarly, that there must be liquid and heat and tremendous pressure under our shoes, for volcanic action and lava require these. Putting such scant evidences together, the scientists built a theory.

The current thought is that the earth is an iron ball surrounded by three layers or shells, each made up of a different material. The iron ball, which is known as the inner core, is about fifteen hundred miles thick. Around this ball is the outer core, a mixture of nickel and iron so hot and under such pressure that it is liquid; geologists say they think that this layer is about fourteen hundred miles thick.

The next layer is the big one, called the mantle, which is about eighteen hundred miles thick. The mantle is made of basalt, the lava rock, and judging from the heat of running lava, the mantle must have a temperature of at least five thousand degrees. Basalt is so heavy, even in the oozing stage, that mere granite practically floats on it.

The final layer of the earth is the outside, known as the crust, made up of a thin skin of light rocks, if you do not mind thinking of the Rockies and Alps and other granite mountains as being light. The depth of this skin ranges from three miles under some parts of oceans to some forty miles in the highest, thickest parts of the continents.

Now, to get to the point of the matter, what the scientists hope to do is to learn whether their speculation is right. To this end, a project has been started by the National Science Foundation to locate one of those thin places where it may occur within two or three miles of the surface of the sea; and having found it, to drill down through the crust at the sea bottom into the mantle with a pipe drill that is two or three inches across—and seven or more miles long! It will be a dazzling triumph when the first mantle rock reaches Science's hand.

To think of it puts perspective on our own efforts, does it not?

Of all the techniques that help a typist turn out a lot of work, especially when the work involves any display, the most useful one is centering; this technique is also the one that you will find the most dangerous, for nothing stands out so clearly as the mark of an office amateur as a word or line that should be centered but is not. Expert centering, therefore, is an art that merits a great deal of practice.

The standard steps by which a typist may center a line or a word horizontally are, of course, well known: You set the carriage at the midpoint of the paper, you press the backspace key once for every two characters or spaces in what you must center, and thus you attain the starting point for typing the line or word. The one caution you must exercise is what you do when you have a single letter left over after backspacing for the pairs: You must not backspace for such a letter.

Once in a while the words to be centered must also be spread; in instances of this nature, you separate letters by one blank space and separate words by three blank spaces. To center such a line, you may proceed in the basic way if you wish, calling off a space after every character that you name in calling the pairs of strokes for which you backspace, but it will dawn on you that naming the space each time is unnecessary, and after that you will use the shortcut: You will just backspace once for each stroke, except the last letter, that the line normally would fill if it were not spread. The last letter has to be excepted, for it's not followed by the space it needs to make a pair.

But there is another way to center which is very useful and will sometimes work better than the basic way. What you do is to set your carriage at the beginning of the space in which you are to center the material; tap the space bar once for each stroke in the words you are centering, and continue tapping the space bar to the end of the space available, counting the strokes to see how many spaces are left over. Dividing your leftovers in half tells you how much the copy has to be indented if it is to be centered within the space you have available.

This method may be used on many occasions. It is efficient, for example, if you must center a heading or title between two margins of unequal width, or a column within a ruled space, or a title below the typewritten name at the end of a letter, or names below the rules for signatures on a legal paper, and so on. If your backspace key is not operating correctly, you can always use this method as a reserve one.

February 18, 19—

William V. Miller

NEW USE OF COLOR INCREASES PRODUCTION RATES

ATLANTA, Ga., Feb. 18--Painting the working spaces in offices and factories with the right color can result in much higher production rates, according to the results of a practical test recently completed by the Research department of Martin Miller & Sons, of this city.

"Using the right color," said Richard Miller, director of the MM&S research program, "does not make the machinery go any faster or the mechanics work any harder. But the right color reduces eye strain and this means much less fatigue, and fewer accidents, and a lessening of tension among workers. Increases in production rates are a natural result."

The test of "color dynamics" was made in several departments of the Clover Mills Company, Wilmington, Delaware. The results credited color with reducing absenteeisms by hundreds of hours and with allover production increases of 7 per cent in the factory and 9% in the offices.

The color is applied to walls, to machinery, and to work areas,--even floors. The plan tested at Clover reduced glare from outside and, at the same time, provided eye-rest areas that lessened eye strain and the tensions to which it usually leads. The paints used, especially manufactured for the purpose by MM&S, are nonreflective and gloss free.

Current Date

Mr. and Mrs. J. W. Swensen
Apartment 9–J West
35–53 187th Street
Flushing, New York 11351

(Salutation)

We are always ~~glad~~ happy to ~~answer~~ reply to questions from ~~our~~ stockholders. Our report for our operations in ~~this~~ the last quarter, which is ~~now~~ being printed, and ~~is to~~ will be mailed in about two weeks, will show that our Net Earnings are $5.04 a share, which is almost a $1.03 gain ~~better than average~~ for ~~this~~ the time of year. These are the ~~data~~ figures:

Gross Revenue	[21]	$55,999,275.00
Net Income before Federal Income Taxes		9,339,180.00
Estimated Fed. Income Taxes		4,905,227.00
Net Income		4,433,953.00
Earnings per share		5.04

We expect a ~~great~~ strong increase in our sales for the next quarter, for we ~~will~~ shall be launching Vita-shine, the fine new product we have been ~~developing~~ working on for more than two years. If Vita-shine lives up to our forecasts, which are based on a careful market ~~survey~~ study, ~~then~~ our sales and profits will show sharp gains, putting us far ahead of any previous ~~profit~~ margin we have enjoyed.

~~I~~ We trust that this ~~analysis~~ information is what you wished. If ~~you have~~ there are other details that you would like to have, we should be ~~very~~ happy to send them ~~along~~ to you.

Yours very truly,

~~Mr.~~ Orville L. Mitchell
Aide to the president

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APPENDIX D

In a day and age when most of our men of science are looking far beyond the skies into the heavens of space, it is interesting to know that other men of science are looking in the opposite direction, down into the earth itself, to see what our world is made of. Men already know more about the space that surrounds our globe than they do about what is in it. We know how to hurtle a mortal hundreds of miles into space; but the deepest hole we have made in the earth is one oil well five miles deep, and the deepest mining shaft is only two miles deep.

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The next layer is the big one, called the mantle, which is about eighteen hundred miles thick. The mantle is made of basalt, the lava rock, and judging from the heat of running lava, the mantle must have a temperature of at least five thousand degrees. Basalt is so heavy, even in the oozing stage, that mere granite practically floats on it.

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PERSONAL TITLES IN BUSINESS LETTERS

The committee appointed by Mr. Wilhelms to study the use of personal titles in business letters found that the subject is amply treated in many sources, most of which concur.

DEFINITION

This report deals with personal titles that are commonly used in business letters, like Professor, Reverend, Doctor, Dean, Miss, Mr., Mrs., and so on. This report does not concern social letters or titles of rank, job, or position.

FINDINGS

1. A personal title of some kind should always be used before a personal name that occurs in any part of a business letter other than in the signer's typed identification, which most often does not include a personal title.

2. Two titles, Mr. and Mrs., are always abbreviated.

3. In addresses, personal titles other than Mr. and Mrs. are written in full only when the last name is given alone, with neither a first name nor an initial; if either is given, the title is abbreviated (if it is one that can be).

4. In a salutation, personal titles other than Mr. and Mrs. may be either abbreviated or typed in full, as a writer may prefer. The trend is toward the short form.

5. In the body, personal titles other than Mr. and Mrs. should be abbreviated if either a first name or initial is given with the last name; if neither is given, the title may be abbreviated or typed in full, as the writer may prefer.

6. In the typed signature, a man does not indicate his personal title unless his first name could be confused with that of a woman. An unmarried woman does not indicate Miss unless her first name could be confused with that of a man. A married woman may (and some authorities say should) have the personal title, Mrs., typed before her name.

Thomas F. Allerton
Virginia Saxon
Chairman

N E W S R E L E A S E

From James M. Donald
Press Syndicate
390 West 44 Street
New York, New York 10036

Release February 17, 19--

A TYPIST CAN WRECK A NEWS RELEASE

DATELINE

NEW YORK CITY, Feb. 17--Many a publicity ~~writer~~ expert works up a fine press release ~~release~~ only to have his typist spoil any chance of its getting ~~any~~ attention on an editor's desk, for how a news release looks is ~~more~~ wise as important ~~than~~ as what it says.

That is what James M. Donald, ~~distinguished~~ chief wire editor for the Press Syndicate, told members of the New York Publicity club at their annual luncheon for news ~~hawks~~ editors, which was attended by 200 publicists at the ~~Savoy Plaza~~ Hilton Statler today.

"We editors receive news releases by the ~~dozen~~ score in every mail," he said, "telling us about the great talent of a stage star or the unsurpassed merits of some new dog food. We ought to read each handout with great care, I know. But an editor is so ~~lazy~~ busy that he is likely to use first whichever release will require the least change and so can be put on the press or on the wire circuit ~~most~~ easily. If you are ~~savvy~~ wise, you'll make your releases easy for the editors to use," ~~he said~~.

Donald gave ~~seven~~ six guides for "easy to use" releases:

1. In the heading, indicate who vouches for the facts.

2. Give a clear title, telling the story in one glance.

3. Start the story with a date line: city and date.

4. Be sure the typing is correct. ~~If we spot an error~~ Errors make editors ~~we~~ wonder whether the release is reliable.

5. Use a 5- or 6-inch line of typing, never longer.

6. Keep the story down to one page if you can. ~~We like double~~ Double = spacing is fine; but if you must single=space, then do so.

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Of the Advertising Committee

MINUTES OF THE MONTHLY MEETING

May ~~18~~ 29, 19--

1½-inch margin

ATTENDANCE

1-inch margin

The regular monthly meeting of the Advertising Committee was held in the office of Mr. Larimore, Advertising Director, who presided at the meeting. The following were present:

Mr. J. Carty	Mr. Fisher	Miss Powell
Miss Clarke	Mr. Larimore	Mr. Stark
Miss Clooney	Mrs. Pavlu	Mr. Wallace
	Mr. Perkins	

put names in 2 columns

The meeting began at two o'clock and adjourned at ~~4:00~~ 4.

OLD BUSINESS

The secretary ~~Miss Powell~~ read the minutes of the last meeting. They were approved as read.

Mr. Stark reported that the show-case cards ~~which~~ that had been prepared for dealers' use ~~had~~ have proved notably successful. His follow-up survey among 250 dealers indicated:

Dealers wanting additional cards	230	(92%)
Dealers using the cards	180	(72%)
Dealers reporting sales increases	215	(86%)

5 5

NEW BUSINESS

Mr. Larimore reported that the Department has been directed to curtail its advertising expenditures by $2,500.~~00~~ for the coming quarter. Discussion hinged on ~~these~~ three possibilities:

1. Elimination of the June Mailing to dealers; and/or
2. Elimination of the space in Premium magazine; or
3. Reduction of space in all magazine ads.

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Mrs. Pavlue reported that the material for the mailing to dealers was now on press and that an investment of $970 would be lost if the mailing were not made. Mr. Perkins pointed out that ~~calcenning~~ cancelling space in Premium would bring our year's space in that magazine under the minimum for the special rates that we have been enjoying. Miss Clarke reported that nearly all mechanicals, art work, and engravings have already been made for our present advertising schedule and would have to be done over, at an estimated cost of $1,500, if the space dimensions were reduced in our advertisements in other magazines. The committee decided to eliminate space in the next three issues of Premium with Mr. Perkins demurring,

Respectfully submitted,

Marguerite Powell, Secretary

Distribution:
Vice-Presidents
Committee Members
Permanent File

APPENDIX E

W-409 Owen Graduate Center
Michigan State University
East Lansing, Michigan 48824
March 6, 1975

Dr. David Weaver
Gregg Publishing Company
Community College Division
1221 Avenue of the Americas
New York, New York 10020

Dear Dr. Weaver:

This is a request for assistance. At the suggestion of my doctoral committee chairman, Mrs. Helen Green, I am writing to you concerning the possibility of the Gregg Division of the McGraw-Hill Publishing Company supplying me with 40 copies of Selective Practice Drills by Lloyd, Poland, Rowe, Winger, and Griffith to be used in an experimental study in intermediate collegiate typewriting. I believe Mrs. Green spoke with you briefly in Chicago last week regarding the study which I would like to begin during the last week of March. I am enclosing a copy of my dissertation proposal which you may read (and keep if you wish) for further clarification.

If the Gregg Division is willing to supply the drill books, I would appreciate having them mailed to my home address as the study will be conducted in Mississippi. The address is as follows:

Post Office Box 152
Mississippi Valley State University
Itta Bena, Mississippi 38941

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Yours very truly,

Carrie McDonald Prater

Enclosure

cc Dr. Alan Lloyd
Mrs. Helen Green

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McGraw-Hill Book Company

May 14, 1975

Ms. Carrie McDonald Prater
W-409 Owen Graduate Center
Michigan State University
East Lansing, MI 48824

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James B. Maher
Business Manager

dmj
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cc: Dr. Alan Lloyd

Approved: Carrie McDonald Prater