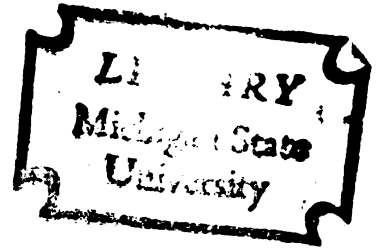A COMPARISON OF TWO METHODS OF TEACHING THE
TYPEWRITER KEYBOARD: SIMULATOR VERSUS THE
CONVENTIONAL CLASSROOM METHOD

Dissertation for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
MARIAN CATHRYN SHAFFER
1976

This is to certify that the

thesis entitled

A COMPARISON OF TWO METHODS OF TEACHING THE
MCDERATOR METHOD: SIMULATION VERSUS THE
CONVENTIONAL CLASSROOM METHOD

presented by

Marian Cathryn Shaffer

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Education

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Date August 12, 1976

O-7639

ABSTRACT

A COMPARISON OF TWO METHODS
OF TEACHING THE TYPEWRITER KEYBOARD:
SIMULATOR VERSUS THE CONVENTIONAL CLASSROOM METHOD

By

Marian Cathryn Shaffer

This study consists of two parts. The first part of the study evaluates the effect of three independent variables, motivation, previous manipulative experience, and motor development on the dependent variable, level of typing performance.

Another purpose of the study is to evaluate the effectiveness of the typewriter simulator, EDU-kee, Model 40/72, developed by Kee, Inc., in presenting the typewriter keyboard in comparison to the conventional classroom training with a teacher and textbook. The effectiveness of the simulator is measured in correct words per minute to determine the differences in level of typing performance attained by the experimental group learning the keyboard with the simulator and the control group learning the keyboard in a regular classroom setting.

Two experimental designs are utilized. Multiple linear regression is used to determine the amount of variance in the dependent variable that is explained by each of the independent variables and by all of them taken together. The Student's t-test is used to determine significiant differences between the experimental and control groups on a pretest and a posttest.

Marian Cathryn Shaffer

The correlational measure of association among the variables shows, that while none of the associations is significant, the greatest strength is between two of the independent variables, previous manipulative experience and motivation, for the experimental group. The strongest association in the control group is between motor development and motivation.

The strongest association with the dependent variable in the experimental group is with previous manipulative experience. For the control group the strongest association with the dependent variable is with motivation. The lowest association with the dependent variable for both experimental and control groups is with motor development.

The Student's t-test indicates a posttest difference between the experimental and control groups with a level of significance of .114 in favor of the control group.

The conclusions of the study are that motivation, previous manipulative experience, and motor development, as measured, are not good predictors of typing performance. The simulator used in this study is not more effective in presenting the typewriter keyboard than the conventional classroom method.

A COMPARISON OF TWO METHODS
OF TEACHING THE TYPEWRITER KEYBOARD:
SIMULATOR VERSUS THE CONVENTIONAL CLASSROOM METHOD

By

Marian Cathryn Shaffer

A DISSERTATION

Submitted to
Michigan State University
In Partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Secondary Education

1976

ACKNOWLEDGMENTS

There are many people who deserve my thanks for their help or kind concern and encouragement, but there are a few that I would like to acknowledge with special thanks.

First, I would like to thank Dr. Robert Poland for directing my efforts, especially at the formative stages. Dr. Poland, who was a major developer of the machine tested in this thesis, did the liaison work between the manufacturers of the machine, The Gregg Division of the McGraw-Hill Publishing Company, and me.

Much appreciation is given to my other committee members, Dr. Billie T. Rader, Dr. Mary Virginia Moore, Dr. Zane Quible, and Dr. Lawrence Borosage, who graciously helped with direction and encouragement even though they were asked for this help after the experiment had been conducted.

Among my committee members, very special thanks are extended to Dr. Rader for his advice on design and statistical problems and for making his time available far beyond my expectations.

The involvement of Mrs. Celestine Mongo, who did the coordinating of the field work at Northern High School, Detroit, Michigan, is appreciated.

I would further like to acknowledge my family for their under-standing and efforts to make my work easier. Their cheerful adjustment to my moments of neglect and change in disposition is much appreciated.

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Chapter 1

INTRODUCTION

This study represents an evaluation of a keyboard simulator that has been developed to help people more easily and quickly acquire the basic skill of typewriting.

Typewriting is a communication tool that has continued to grow in importance. Industry has increased its reliance on the printed page. High schools have come more and more to view typewriting as an essential college preparatory course. Such increased demands have put new pressures on those in the field of typewriting instruction to develop more efficient instructional procedures.

If there is value in this effort, the value will most likely come from the part played in helping people in our complex world communicate more efficiently.

This study may help by providing more information as to the direction that needs to be taken in absorbing the vast amount of technological innovations flowing into the educational community from an ever-growing industry.

Technological advancements in our society have brought much progress in fields such as industry, communication, and medicine. There is no need to reiterate the tremendous strides that technology has enabled people to make in these areas. Technological media are also being increasingly used in many educational settings. However, the area of

education does not seem to have benefited so much as in other fields.

In contrast to technology in industry, communication, and medicine,

little is known about the effectiveness of educational technology and

where it is going. It is used haphazardly with little base in an

organized body of knowledge. As stated by Ofiesh (1964, p. 2):

> . . . there has been no revolutionary breakthrough in the
> process of education and training. There have been no
> advances in instructional theory, methods, or in the
> development of procedures by which people can learn more
> rapidly and more effectively.

Within the field of business education the value of efficient and

effective use of teaching machines might be enormous. There are many

areas of potential effectiveness such as typewriting, office machines,

data processing, and rule learning in areas such as filing. If more

of these skills and procedures could be learned as effectively on

teaching machines as through conventional methods (regular classroom

instruction), the teacher could then be free to use time to better

advantage in working with students whose learning situations more clearly

demand the teacher's personal attention.

The typewriting simulator used in this study would be expected to

enable students to learn the typewriter keyboard without the presence of

a teacher. There are a number of advantages this method of learning

affords:

To the student: (1) Each individual can move at his own pace; no

one is held back by slower learners nor pushed ahead too fast in attempt-

ing to keep up with the majority of the class. (2) Immediate feedback, a

feature built into the machine, gives the student instantaneous knowl-

edge of the mistakes he makes. Correct responses are reinforced, while

incorrect responses require immediate correction, thus lessening the

chance for incorrect stroking to become a habit. (3) The forced correction of incorrect responses permits more thorough learning of the keyboard. The student has to make the right responses before advancing to the next lesson. (4) The student is an active participant in the learning process. Self-direction is an important aspect of the learning process.

To the teacher: (1) The teacher is not forced to stand at the front of the room giving presentations. He is free to give attention to the students individually. (2) The teacher, being free of the mechanical aspects of presenting the keyboard, can spend time praising and encouraging the students, an opportunity which many classroom situations seldom allow because of lack of time. (3) Because of the active participation on the part of the students, the teacher can be sure the student's attention is held to the task at hand. (4) The machine provides a more flexible teaching style in which the teacher can move around the room more freely and work with students in a large group, small groups, or individually as desired.

Need for the Study

Business education is often criticized for its slow rate of adoption of new practices. Many new technological innovations are being offered, but relatively few are being brought into general use. Efficient adoption of new educational practices cannot come about if teachers and administrators have little or no information about the effectiveness of the technological alternatives which are being offered. This research has been undertaken to provide (a) information about a simulator and how it works, (b) evaluative information on the simulator, and (c) an

approach to evaluation of such devices. It is hoped that the results of these efforts will be of use to educators in the classroom as well as to the developers and evaluators of such devices for the future.

Purpose of the Study

The purpose of this study is to evaluate the effectiveness of the typewriter simulator EDU-kee, Model 40/72, developed by Kee, Inc., in presenting the typewriter keyboard in comparison to the conventional classroom training with a teacher and textbook. The effectiveness of the simulator will be measured in correct words per minute to determine the differences in level of typing performance attained by the experimental group learning the keyboard with the simulator and the control group learning the keyboard in a regular classroom setting.

Hypotheses

The level of typing performance measured in correct words per minute is the dependent variable. Three independent variables are also used in this study. They are previous manipulative experience, motor development, and motivation. This study attempts to determine the relationships, if any, between varying levels of these variables to the level of typing performance.

The following are the hypotheses stated in null form:

H_1: There will be no significant difference in level of typing performance attained by the group using the simulator and the group receiving regular classroom instruction.

H_2: There will be no significant relationship between level of motivation and level of typing performance.

H_3: There will be no significant relationship between level of motor development and level of typing performance.

H_4: There will be no significant relationship between level of previous manipulative experience and level of typing performance.

Assumptions of the Study

The following assumptions were made:

1. The measures employed in this study are adequate and appropriate indicators for the concepts they were expected to measure.

2. The effects of the typing simulator found in this study are not due to Hawthorne effect (a temporary fascination with something new).

3. The effects of the typing simulator found in this study are not due to classroom teacher attitudes toward the machine.

4. The variables motivation, motor development, and previous manipulative experience are important in learning to type.

5. The size of the sample is sufficient to draw conclusions about the larger population.

6. The instruments used to collect data on the independent variables were both reliable and valid for the sample.

7. Future research would replicate or cross-validate the results of this study.

Limitations of the Study

1. Limitation as to population characteristics. This study was of a characteristic or representative population of subjects. It is hoped that it was an appropriate, typical selection of subjects; but neither the schools selected nor the subjects were selected by random sampling procedures. Therefore, no attempt is made to statistically generalize to any other population or sample.

2. <u>Limitation as to the set of independent variables</u>. Part of this study is concerned with the explanatory power of three independent variables. No claim is made that these variables are either mutually exclusive or exhaustive. Other sets may, in time, prove to be more effective explainers of the level of typing performance. No attempt is made in this study to claim that these are the most important independent variables.

3. <u>Limitation as to the duration of the treatment time period</u>. The duration of the test time period was arbitrarily set at one semester. It is quite possible that longer time periods might produce greater or lesser effects. Therefore, no attempt is made in this study to draw implications as to the effect of longer treatment periods.

4. <u>Limitation as to long-term effects</u>. It is possible that there is differential with respect to long-term retention of skills built by the two teaching methods. No follow-up was attempted as a part of this study to determine whether such long-term differences exist.

5. <u>Limitation as to change in original design</u>. The second experimental classification, the group which was to use the simulator as a supplement to the teacher, was dropped when teachers became complacent about the rigors of the study.

Three schools which initially agreed to be a part of the experiment dropped from the study largely because of the necessity to change lesson plans at the last minute, and also, because the machines had not been delivered on the promised date twice, which added to teacher anxiety.

Delimitations of the Study

1. <u>Delimitation as to the specific typewriting simulator being evaluated</u>. This study tested only the KEE simulator. While it is hoped that this study provides a better understanding of a variety of simulator devices, only one was empirically studied. No attempt is made to provide empirical implication for the effectiveness of any other simulator or related device.

2. <u>Delimitation as to the skill level of the subjects</u>. In this study all of the subjects were at the beginning level. During the study they learned only the keyboard and elementary levels of skill. While the KEE machine is also designed for higher levels of skill building and remedial drills, only the tapes for keyboard learning (Set 1) were used. No attempt was made in this study to test the machine's capability to contribute to skill building at these higher levels.

3. <u>Delimitation as to the age level of the subjects</u>. In this study all of the subjects were of high school age. No attempt was made to see whether there was differential for either younger or older subjects.

Definition of Terms

Simulator: the simulator is an electronic device with a keyboard similar to that of a typewriter. It is designed to be used with an accompanying drill book. As the subject "types" the drills in the book, a pre-punched tape located on the left side of the machine automatically is fed through a tape reader. When an error is made by the subject, the tape does not advance, thus forcing the keyboard to lock until the subject "corrects" the error by striking the correct key. The back panel

of the machine may light up as each correct key is struck, depending on the choice of the machine's user.

Timed writing (straight copy timed writing): manuscript material in paragraph form to be copied exactly as is for a set number of minutes.

Production timed writing: problem typing situations in which the subject must set up letters, figure tabulations, or set up manuscripts rather than merely copy from the book.

Gross words per minute: the entire number of words typed by the subject during a five-minute timed duration.

Correct words per minute: obtained by subtracting the number of errors made in a five-minute timed writing from the total number of words attained, then dividing that result by the number of minutes' duration of the timed test (in this study, five).

Traditional or conventional method of teaching the keyboard: using the methods prescribed in the textbook utilized in the class; presenting the keys lesson by lesson according to the text with no additional teaching aids.

Sight method of teaching the keyboard: locating the new keys by looking at the keyboard until the key is learned by memory.

Tapping test: a test designed to measure aptitude for typewriting. The examinee is instructed to tap quickly and accurately with one finger at a time and to associate a particular finger movement with a particular letter of the alphabet. A miniature alphabet is used and colored felt dots are attached to the finger tips. The tapping is done in a test booklet in which printed circles represent the surfaces of eight typewriter keys.

Home-row keys: the keys from which the fingers do their reaching. The keys for the left hand comprising the home row are a, s, d, f, and for the right hand, j, k, l, ;.

Chapter Descriptions

The order of presentation of this study as it attempts to complete the above outlined objectives is as follows:

Chapter 2 will review some of the pertinent typewriting studies involving the use of electronic, mechanical, and visual media in teaching the keyboard.

Chapter 3 will present the methodology. This chapter first provides a brief description of the simulation device that is tested in this research. Then the precise research design and field procedures that were attempted are described. Finally, the statistical techniques employed in this study are described.

Chapter 4 will present the findings, primarily in tabular form. No attempt is made either by comment or order of presentation to highlight or interpret the significance of these findings. This task is left for the final chapter.

Chapter 5 will present the summary and recommendations. In this chapter an attempt is made to review the significance of the findings. Implications are drawn with respect to the original design, limitations, and delimitations. Finally, the prospects and further development of the tested instructional device are discussed.

Chapter 2

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to present the research related to

this study. The cited studies all involve the use of teaching aids in

presenting the typewriter keyboard and are subdivided into the

following classifications:

1. Visual aids--devices including overhead projectors with
    transparencies, videotape and closed circuit television
    for viewing typewriting techniques, chalkboard, and
    wallcharts.

2. Audio-visual aids--a combination of visual aids and sound tapes.

3. Mechanical aids--motor driven devices such as pacesetters
    attached to the typewriter carriage to regulate typing speed,
    diagnostic devices designed to diagnose typing patterns and
    difficulties.

4. Electronic aids--devices that are transistorized, electric,
    and use lights.

5. Multi-media aids--combinations of two or more devices mentioned
    in the first four classifications.

A brief summary of the related research is the last section of this

chapter.

Visual Aids

A videotape feedback system was used by Currie (1974) to study its

effectiveness on student achievement in beginning college typewriting

classes with reference to speed, accuracy, and typing techniques on

straight-copy material.

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Two experimental groups and one control group were used. The investigator taped the typewriting techniques of the two experimental groups (group two and group three). Group two received individual replay of their typewriting techniques, while group three received replay of their typewriting in seven subgroups of three students each. Group one was the control group and did not receive the videotape replay.

Classes met three days a week for eleven weeks. At the end of the treatment period, five-minute timed writings were analyzed to determine whether there were differences in speed, accuracy, and correctness of technique among the three groups. Although there were no significant differences, it was found that group two had higher speeds and better accuracy than groups one or three.

From these findings, Currie concluded that the use of the videotape feedback system is most effective when students receive videotape replay on an individual basis.

Smith (1969) did an experimental study to determine the effectiveness of closed circuit television in presenting the typewriter keyboard to beginning students. The experimental group was filmed while typing the daily lessons for the purpose of showing the students incorrect techniques among the group. The control group was not filmed.

Timed writings were given to each group approximately every two weeks. Gross words a minute and errors were recorded. The findings showed a significant improvement in both speed and accuracy on the part of the experimental group at the end of the experimental period. Smith concluded that the closed circuit television is an effective method of teaching the typewriter keyboard.

Cary (1961) compared the achievement between students learning the keyboard by the wallchart method versus students learning by the sight method. The experimental group located the position of the keys by looking at the wallchart at the front of the room and were instructed not to look at their hands while their fingers were positioned on the home-row keys. The control group looked at the keyboard to locate new keys.

The words and sentences, which were written on the chalkboard by the instructor, were memorized by both the experimental and control groups. Both groups then typed the memorized words and sentences while the instructor dictated them. No text was used for either group. Evaluations of student achievement were made on the basis of 12-second, one-minute, and five-minute straight copy timed writings.

Cary found no significant differences in speed and accuracy between the experimental and control groups.

A study involving the use of the chalkboard was done by Price (1967). She used two beginning typewriting classes, a total of 57 students. The experimental group learned the keyboard entirely from illustrations of locations of new keys put on the chalkboard. The control group used the textbook to learn the keyboard in the conventional manner.

Three one-minute timed writings were used to measure the speed and accuracy of both groups. Price found no significant differences between the experimental and control groups, but she noted slightly higher speeds in the experimental group.

Dalton (1967) experimented with using an overhead projector and transparencies in presenting the typewriter keyboard. She made

transparencies of the keyboard with overlays to block out the keys not being learned. The control and experimental groups were matched for intelligence and classification (sophomore, junior), and for college bound.

No statistical analyses were made on the data, but Dalton reported that the experimental group had an average of eight words a minute more than the control group on the final timed writings given at the end of the semester.

Audio-Visual Aids

Curlott (1974) compared an audio-visual method to the conventional method of teaching the typewriter keyboard. Ten students were assigned to four sections; two sections were control groups and received traditional instruction on the keyboard. The third section received keyboard instruction by taped instructions and a manual in a classroom. The fourth section received the same type of instruction in a mobile unit. On the basis of the tapping test, all were ranked on high or low ability groupings.

Timed writings were given three times during the experiment to measure student achievement. No significant differences were found between students who were predicted to have high aptitude or low aptitude from the tapping test. The experimental group did perform better than the control group but not significantly.

Mechanical Aids

A study of the Gregg/Pacesetter was undertaken by Trexler (1972). The Gregg/Pacesetter is a timing and pacing device designed to automatically maintain the speed at which the learner wants to type.

She studied the relationships between gain in speed and accuracy with intelligence, reading rate level, reading vocabulary, and sex between the experimental and control groups. Two control and two experimental groups were used. Both groups typed the same drills for 15 minutes at the beginning of class. The experimental group used the pacesetter on the drills while the control group did not. The students kept track of their one-, two-, and three-minute timed writings. The pacesetter group set the instrument according to their own level of achievement.

Trexler concluded that while there were no significant differences between the two groups, the lower intelligence group did better when using the pacesetter as an instructional device for developing speed. Accuracy was developed more successfully by male students with the pacesetter and by lower intelligence, lower reading vocabulary and comprehension levels.

The Diatype was studied by Shell (1965) in two beginning type-writing classes, totaling 58 students. The experimental group used the Diatype while the control group did not. The Diatype was used for diagnostic testing on Mondays, and corrective drills were used the rest of the week.

Eight one-minute timed writings were given as well as eight three-minute and eight five-minute timed writings. From the gross words a minute attained, the skill development of the students was measured. There was no significant difference in the groups in number of errors, but the experimental group was somewhat more accurate. There was, however, a significant difference reported in the attainment of speed as the experimental group attained a higher

speed than the control group. From the findings, Shell concluded that the Diatype is an effective instrument for building typewriting skill, particularly speed.

Johnson (1962) studied the effectiveness of the Skill-Builder Controlled Reader training in developing typewriting skill at the collegiate level. Four beginning and four intermediate typewriting classes were used amounting to 176 students. The beginning classes were divided into an experimental group which used the Controlled Reader to build typewriting skills, and a control group which learned the keyboard in the conventional manner.

Accuracy and speed were measured by one and five-minute timed writings. The intermediate classes were also divided into an experimental group which used the Controlled Reader and the control group which learned to type in the conventional manner. Speed and accuracy were measured by five-minute timed writings only. An analysis of the data showed no significant differences between the experimental and control groups in either the beginning or intermediate classes, but when beginning and intermediate experimental groups were totaled together, there was better performance by the experimental group.

Sherrill (1975) compared three methods of training students to type. Two experimental groups and a control group were set up. One experimental group learned the keyboard with a commercially-vended program of instruction that involved a group-pacing device. The second experimental group learned the keyboard individually paced. The control group learned in the traditional way. All students were divided into high, medium, and low ability groups based on a typing aptitude test.

The results showed no significant correlation between either of the experimental groups nor between experimental and control.

Electronic Aids

Guyot (1973) studied the effects on speed and accuracy when using an electronic wallchart as compared with traditional instruction to introduce the typewriter keyboard. One hundred-sixty-one (161) ninth graders in beginning typewriting participated in the study and were assigned to three experimental and three control groups.

Two-minute timed writings were used to evaluate the skill level of the students at four different times during the experiment. One-minute timed writings were used three times during the experiment. From gross words a minute, analysis was made to determine whether the groups differed in achievement. The findings showed no significant differences between experimental and control groups in speed, but girls had better results than did boys in both the experimental and control groups, and the control group had significantly fewer errors than the experimental group.

Cook (1972) conducted a study utilizing an electronic wallchart. Students from two beginning college typewriting classes were randomly assigned to an experimental group, which learned the keyboard with the assistance of the wallchart, and a control group, which learned the keyboard in the conventional manner. Cook found that the experimental group made significantly fewer errors than the control group, but no significant differences were found in speed between groups.

Stephens (1966) used an illuminated typewriter keyboard chart called the "Type-Lighter," which consisted of a box measuring 40" x 5 1/4" x 19" with holes cut in for letters. Behind the holes were light bulbs which would light up when the key was depressed. Stephens' purpose in this study was not to statistically test the effectiveness of this device but to build it and explain its use. Stephens concluded that the device could be used in conjunction with educational television and would be effective in holding students' attention.

Multi-Media Aids

An experimental study using the Skill-Builder Controlled Reader with an overhead projector was done by Decker (1969) to determine the effectiveness of a combination of visual aids.

Two beginning college typewriting classes totaling 35 students were used. The experimental group learned the keyboard with the aid of the Controlled Reader and transparencies showing the location of the new keys. The control group learned the keyboard in the conventional manner.

One-minute and three-minute timed writings were used to measure the skill between the groups at the end of each two-week period. Decker found a significant difference in groups in the higher speed attained by the control group. While not significant statistically, the experimental group did reduce errors more than the control group.

In a study by Dorn (1966) the use of the chalkboard, overhead projector, and supplementary drills were used by the experimental group. The control group was instructed in the traditional manner. The number keys were the only part of the keyboard involved in this study. Two junior high school classes totaling 61 students participated.

To test the skill of the students on typing numbers, three one-minute writings of copy containing numbers mixed with straight copy and three one-minute timed writings on straight number copy were given at the beginning of the experiment and at the end of each six-week period. Dorn found that the experimental group improved more than the control group in accuracy and also in straight number copy. Dorn concluded that the use of the overhead projector, chalkboard, and supplementary drills contributed to better skill in learning to type numbers than the regular textbook.

Jones (1974) did an experimental study to compare audio-tutorial instruction with traditional instruction in beginning typewriting. One hundred-ninety-two (192) beginning typing students in three community colleges were divided into nine classes taught by three teachers. Five classes totaling 99 students comprised the experimental group and four classes comprising 93 students were the control group.

The experimental group used video tapes, listening stations, audio cassette players, printed matter, and films to learn the key-board. The control group learned the keyboard in the traditional manner. Measurement of skill attained by the two groups was obtained from timed writings on straight copy and production tests consisting of letters, tabulations, and manuscripts. Gross words a minute and errors were used to compare the skill achieved by the groups.

No significant differences were found between the two groups.

Frye (1972) used 175 students in five junior colleges to study the effect of using a combination of taped typewriting lessons and a syllabus listing the performance objectives. The students were

randomly assigned to the experimental and control groups and were

taught by the same teacher. The experimental group learned the key-

board by reading the syllabus before each lesson and then proceeded

with the day's lesson via taped instructions.

Three timed writings were given during the treatment period to

evaluate the skill level of the students. Frye found that the ex-

perimental group gained in speed significantly over the control group

with 6.49 words a minute for the experimental group and 3.58 for the

control group.

Thoreson (1971) compared the performance of students using a

large group individualized multi-media approach with the performance

of traditionally taught classes. Seventeen high schools were in-

volved, totaling 1,298 students, 496 assigned to the experimental

group and 802 to the control group. The groups were matched for

percentage of male and female, grade point, and by reason of course

election.

Thoreson found that the multi-media group typed significantly

faster on straight copy timed writings and production writings.

The control group, however, typed significantly more accurately on

straight copy timed writings. The experimental group typed signifi-

cantly more accurately on production writings.

Another use of multi-media is the Automated Instruction Touch

Typing System. The AITT is a program which utilizes a sound pro-

jector and a large screen which shows a color-coded keyboard. The

keys being learned light up on the screen, while taped instructions

and drills direct the students in striking the keys and in practice

on the new keys. The eleven thirty-minute films begin at a pace of

only four words a minute and end up at eight words a minute. Additional

individual work can be done with the use of auxiliary projectors and

side screens which accommodate six to eight students.

Dupras (1972) conducted an experiment comparing the Automated

Instruction Touch Typing system to the traditional method. The sample

contained six beginning typewriting classes totaling 132 students.

Four times during the treatment period, speed and accuracy were

measured by three-minute timed writings. Analysis of the data showed

that the experimental group using the Automated Instruction gained

significantly in speed. The control group only performed significantly

better in accuracy in the final testing period. Dupras concluded that

making a judgmental statement on the basis of the results of only one

testing period out of four would not be possible. More investigation

would be needed in the area of accuracy.

The evaluation of eight training programs utilizing various media

in teaching beginning typewriting in a military setting was reported

by Showel (1974). The media employed in the training programs consisted

of audio tapes, typewriter simulators, and visual aids such as keyboard

charts, printed exercises, and manuals.

Five-minute timed writings after one hour of practice and after

every three and three-fourths hours of practice were given to measure

the skill of the subjects. The results indicated that the most effective

programs were those which emphasized speed in forced-pace drills.

Summary

Many of the studies, notably those that used electronic aids and

multi-media, reported significant increases in speed and/or accuracy.

While the electronic wallchart was effective in increasing accuracy, several multi-media approaches were effective in increasing speed.

While not reporting significant differences, many of the other studies noted tendencies in the experimental group toward greater speed and accuracy. The use of teaching aids in presenting the typewriter keyboard has been shown to gain good results when compared with the traditional teaching methods.

Chapter 3

DESIGN OF THE STUDY

This chapter provides a detailed explanation of the methods and procedures followed in conducting the empirical tests of the hypotheses. This explanation will include the following:

1. A description of the device which was field tested.

2. A description of the research design.

3. An explanation and description of sampling procedures.

4. A review of the variables and a detailed description of the empirical operations that were used to measure each of these variables.

5. A summary of the data collection procedures.

6. A statement of the analysis procedures and techniques that were employed to test the empirical hypotheses.

Description of the Typewriter Simulator

The typing simulator in this study was kept very close to the size and appearance of an IBM keyboard. The basic difference in appearance and operation is that the simulator operates in conjunction with a pre-punched paper tape which provides script information to the machine. Also utilized is a textbook of manuscript copy which corresponds to the tape information. As the student types from the corresponding textbook, the pre-punched tape rolls through a tape-feed on the left side of the machine. There is flexibility in how the machine may be employed, depending upon how the user or the teacher chooses to handle the reward-penalty reinforcement.

The machine has three basic parts: (1) the illuminated keyboard display panel, (2) the keyboard, and (3) the tape reader. Refer to Appendix B for an illustration of the simulator.

The four ways in which the reinforcement can be used are described below.

Mode 1: If the student wishes to operate the machine on Mode 1, the mode dial is turned to Mode 1. As the tape is fed through the tape feed, the letter that is to be struck lights up on the display panel. The student is instructed to strike the key that is lighted on the display panel. As the student correctly strikes the key, the tape advances, and the next key to be struck lights up on the display panel. The student continues to strike each key as indicated on the illuminated display panel.

If an error is made, the tape stops and the keyboard becomes inoperative. The correct key must be struck before the tape and keyboard are in operation again.

Mode 2: If the student wishes to operate the machine on Mode 2, the mode dial is turned to Mode 2. In this operation, the student types the illuminated key as in Mode 1. The only difference between Mode 1 and Mode 2 is in the manner of reinforcement. When an error is made in Mode 2, an additional step must be taken before continuing. Upon making an error, the student must press an error button on the keyboard before continuing to the next letter.

Mode 3: If the student wishes to operate the machine on Mode 3, the mode dial is turned to Mode 3. In Mode 3 the student is instructed to type from the textbook that is used in conjunction with the lesson.

The display panel does not light up as the student types. When an error is made, the key that should have been struck lights up on the display panel. The student then strikes the correct key and continues.

Mode 4: If the student wishes to operate the machine on Mode 4, the mode dial is turned to Mode 4. In this operation, the student types from the textbook as in Mode 3. The only difference between Mode 3 and Mode 4 is in the manner of reinforcement. When an error is made in Mode 4, an additional step must be taken before continuing. Upon making an error, the student must press an error button on the keyboard before continuing to the next letter.

The Sample

Initially, in the fall of 1972, four schools were selected from the ten that were contacted. They were Northern High School, Grosse Pointe, Dondero, and Oak Park in the Detroit area. Not all of the schools that were contacted were considered appropriate for one or both of the following reasons: (1) confusion in class size and student-teacher assignments and (2) teaching methods (e.g., ability grouping and open system) did not make possible adequate isolation of experimental and control groups. Students were randomly assigned to either the experimental or control groups. The final number of students utilized, with only Northern High School participating, was 47 students serving in the control group and 25 in the experimental group.

Variables

The four variables for both the predictive and pretest-posttest designs were (1) previous manipulative experience, (2) motor development

(3) motivation, and (4) level of typing performance. The operational definitions of each of these is summarized below.

Independent Variables: Variable X_1, level of previous manipulative experience--operationally defined as the subject's estimated number of years of previous experience on activities similar to the typewriting experience, such as piano playing; playing other musical instruments; hobbies and work requiring use of the fingers and hands, such as sewing and building models. This information was obtained from a questionnaire asking the students to record the number of years' experience they had had with such activities.

Variable X_2, level of motivation--operationally defined as the subject's degree of enthusiasm with respect to learning to type. This information was obtained from the subject's self-rating scale from very enthusiastic, somewhat enthusiastic, somewhat unenthusiastic, to very unenthusiastic. The score of 3 was given to the response "very enthusiastic," while a score of 0 was given to "very unenthusiastic."

Variable X_3, level of motor development--operationally defined as the scores obtained by subjects on the Purdue Pegboard Test of Motor Development. This test was designed to measure gross movements of arms, hands, and fingers as well as "tip of finger" dexterity. Its use is recommended for adolescents in grade 9 through adults for predicting success in occupations requiring manual dexterity. Reliability data reported for this test indicates that test-retest correlations for testing left-hand movements, right-hand movements, and both hands is .86. Validity has not been satisfactorily established but has been reported to be .64.

Dependent Variable: Variable Y_1, level of typing performance—
operationally defined as the number of correct words per minute typed
by subjects on five-minute timed straight-copy writings.   The same
timed writings were used for all subjects, and they were administered
on the same days to both groups.

Description of the Research Design and Analysis Techniques

Two experimental designs were utilized in this study.   The first
was a correlational experimental design to determine the relationship
between the independent variables, PREVIOUS EXPERIENCE, MOTIVATION,
and MOTOR DEVELOPMENT, and the dependent variable, CORRECT WORDS PER
MINUTE.   The second design was the pretest-posttest control group design
to determine the significance of the difference between the means of the
posttests of the experimental and control groups.

Correlational experimental design: This experimental design was
utilized to determine the relationship between the independent variables,
PREVIOUS EXPERIENCE, MOTIVATION, and MOTOR DEVELOPMENT to the dependent
variable, CORRECT WORDS PER MINUTE.   Linear multiple regression was used
for this analysis.   Each of the independent variables was tested
separately to determine its effect on the dependent variable.   Then,
through an application of a forward stepwise multiple linear regression
analysis, a second independent variable was added to the first to deter-
mine the additive effect of the two independent variables on the dependent
variable.   Finally, the third independent variable was added to the first
two independent variables to determine the total effect of all three
independent variables on the dependent variable.   The model of this
design is shown on the following page.

FIGURE 1

RESEARCH DESIGN FOR MEASURING THE EFFECT OF THE
INDEPENDENT VARIABLES ON THE DEPENDENT VARIABLE

Independent Effect of Each Variable

Independent Variables	Dependent Variable
Motivation	Correct Words Per Minute
Motor Development	Correct Words Per Minute
Previous Experience	Correct Words Per Minute

Additive Effect of All Variables

Motivation	Correct Words Per Minute
Motivation + Motor Development	Correct Words Per Minute
Motivation + Motor Development + Previous Experience	Correct Words Per Minute

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Pretest-posttest control group design: The next design utilized was
an experimental-control test-retest to determine significant differences
between the experimental and control groups on a pretest and a posttest.
A Student's t-test was used for this analysis. See Figure 2 for a
summary of this design.

FIGURE 2

RESEARCH DESIGN FOR MEASURING THE
DIFFERENCE BETWEEN PRETEST AND POSTTEST

Group	Pretest	Posttest
Experimental group	25 subjects	25 subjects
Control group	47 subjects	47 subjects

Data Collection

Training of classroom teachers: The research sites were visited several times by the researcher to familiarize the teachers with the study and the actual operation of the typing simulator. Arrangements were made for the researcher to attend the first two weeks of class meetings for the following two reasons: first, to help the classroom teacher with orientation to the study and the machine operation, and second, to implement the series of initial tests.

Testing of subjects: A brief orientation was conducted with the experimental group to explain the operation of the simulator on the first day of class. On the second day of class the questionnaires developed to measure motivation and previous experience were administered. The motor development test, which was administered on a one-to-one basis with all subjects, was conducted by this researcher over the first seven days of class. For each of the individual motor development tests the subject was called out of class and administered the test with as little outside interference as possible.

Summary

The typewriting simulator used in this study was tested over a period of one semester in Northern High School, Detroit, Michigan. The experimental group learned the keyboard on the simulator without the aid of a teacher, and the control group received classroom instruction in the traditional manner, with no exposure to the simulator.

The independent variables used in the study were PREVIOUS MANIPULATIVE EXPERIENCE, MOTOR DEVELOPMENT, and MOTIVATION. The dependent variable was CORRECT WORDS PER MINUTE. Tests were given during the first few days of class to assess the subjects' previous experience with activities similar to typewriting; subjects' level of motor development as measured by the Purdue Pegboard; subjects' motivation measured by a self-rating scale of enthusiasm for learning to type; and finally, their level of typing performance as measured by five-minute timed writings.

To test the relationship between the dependent variable and the independent variables, the multiple linear regression technique was utilized. The t-test was used to test the significance of difference between posttest scores between experimental and control groups and also pretest and posttest differences within the experimental and control groups.

Chapter 4

FINDINGS

The previous chapter described the research procedures and techniques
that were used to test the hypotheses of this study. This chapter pre-
sents the findings which resulted from these procedures.

All hypotheses were tested in the null form and criterion levels
for rejecting the null are presented as computed rather than employing
a single criterion level for all tests.

The order of presentation is as follows:

1. Descriptive statistics, Tables 1 through 4, showing the means,
standard deviations, and ranges of the variables.

2. Analytical statistics of the predictive design, Tables 5 through
9, showing relationships of the independent variables to the dependent
variable.

3. Analytical statistics of the pretest-posttest design, Tables 10
through 12, showing differences in means between the experimental and
control groups.

4. Summary.

Descriptive Statistics

Tables 1 and 3 present the mean and standard deviation for each of
the variables in the study (CORRECT WORDS PER MINUTE, MOTOR DEVELOPMENT,
MOTIVATION, and PREVIOUS EXPERIENCE): first for the experimental group

(Table 1) and then for the control group (Table 3). The means scores of CORRECT WORDS PER MINUTE presented in Tables 1 and 3 were calculated using the average of the pretest and posttest scores.

TABLE 1

MEANS AND STANDARD DEVIATIONS PER VARIABLE
FOR THE EXPERIMENTAL GROUP (N=25)

Variable	Mean	Standard Deviation
Correct words per minute	17.56	13.12
Motor development	42.00	6.82
Motivation	2.16	.98
Previous experience	1.20	1.62

Table 1 shows that the mean of the variable CORRECT WORDS PER MINUTE for the experimental group was 17.56. The mean for MOTOR DEVELOPMENT was 42.00, and the mean for MOTIVATION was 2.16.

The ranges of the variables for the experimental group are shown in Table 2 on the following page.

TABLE 2

RANGE OF SCORES FOR EACH VARIABLE
FOR THE EXPERIMENTAL GROUP

Variable	Low	High
Correct words per minute	12.50	25.00
Motor development	29	56
Motivation	0	3
Previous experience	0	7

Table 2 shows that the range of scores for the variable CORRECT WORDS PER MINUTE for the experimental group was from 12.50 to 25.00. MOTOR DEVELOPMENT had a range from 29 to 56. MOTIVATION had a range of zero reported for some subjects to a high of 3. PREVIOUS EXPERIENCE had a range from zero to 7.

TABLE 3

MEANS AND STANDARD DEVIATIONS PER
VARIABLE FOR THE CONTROL GROUP (N=47)

Variable	Mean	Standard Deviation
Correct words per minute	18.96	14.36
Motor development	41.60	5.99
Motivation	2.15	1.02
Previous experience	1.28	1.36

Table 3 shows that for the control group the mean for the variable CORRECT WORDS PER MINUTE was 18.96. MOTOR DEVELOPMENT had a mean of 41.60. The mean for MOTIVATION was 2.15 and for PREVIOUS EXPERIENCE, 1.28.

A comparison of Tables 1 and 3 shows that the mean for the control group at 18.90 was slightly higher than that for the experimental group with 17.56. The control group, however, had a slightly lower mean for MOTOR DEVELOPMENT with 41.60 compared to 42.00 for the experimental group. The means for MOTIVATION for both groups were nearly equal with 2.16 for the experimental group and 2.15 for the control. The control group showed a higher mean for PREVIOUS EXPERIENCE with 1.28 while the experimental group had a mean of 1.20.

TABLE 4

RANGE OF SCORES FOR EACH
VARIABLE FOR THE CONTROL GROUP

Variable	Low	High
Correct words per minute	13.50	28.00
Motor development	29	54
Motivation	0	3
Previous experience	0	6

Table 4 shows that the range of scores for the variable CORRECT WORDS PER MINUTE for the control group was 13.50 to 28.00. MOTOR

DEVELOPMENT had a range from 29 to 54. MOTIVATION had a range from

zero to 3. The range reported for PREVIOUS EXPERIENCE was from zero

to 6.

A comparison of Tables 2 and 4 shows that the range of scores

for CORRECT WORDS PER MINUTE for the control group (13.50 to 28.00)

was higher than the range (12.50 to 25.00) for the experimental group.

The range for MOTIVATION for both groups had a low of 29, but the

experimental group had a higher range of 56, while the control group

had a high range of 54. The range for MOTIVATION was the same for both

groups with a low of zero and a high of 3. The experimental group

showed a slightly wider range for PREVIOUS EXPERIENCE, reporting a

range of zero to 7, while the control group had a range of zero to 6.

TABLE 5

MATRIX OF CORRELATION COEFFICIENTS FOR THE
VARIABLES FOR THE EXPERIMENTAL GROUP (N=25)

Variable	Correct words per minute	Motor Development	Moti-vation
Motor development	.00708		
Motivation	-.01829	.09200	
Previous experience	.08992	.24085	-.35691

Table 5 presents a matrix of intercorrelations among all of the

variables utilized in this study. It can be seen that the correlations

are very low, indicating low relationship with one another. The fact

that there was low correlation among the independent variables indicates

that there was little overlapping of predictability. The low relation-

ship of all of the independent variables with the dependent variable

indicates that the combined variance of the independent variables will

be poor predictors of the dependent variable.

The intercorrelations among the independent variables show that

the variables MOTOR DEVELOPMENT and PREVIOUS EXPERIENCE were the most

highly correlated variables with a correlation of .24085. MOTIVATION

and PREVIOUS EXPERIENCE were negatively correlated (-.35691). This

inverse relationship means that as scores on one variable increase,

the scores on the other decrease.

The variable, CORRECT WORDS PER MINUTE, correlated most highly

with PREVIOUS EXPERIENCE with a coefficient of .08992. The relation-

ship coefficients of MOTIVATION and MOTOR DEVELOPMENT with CORRECT

WORDS PER MINUTE were even nearer to zero.

TABLE 6

MATRIX OF CORRELATION COEFFICIENTS FOR THE
VARIABLES FOR THE CONTROL GROUP (N=47)

Variable	Correct words per minute	Motor Development	Moti-vation
Motor development	-.00058		
Motivation	.05130	.35262	
Previous experience	.02436	.23889	.26663

Table 6 presents the matrix of correlations for the variables of

the control group.

The matrix of intercorrelations among the independent variables showed that the variables MOTOR DEVELOPMENT and MOTIVATION were the most highly correlated variables with a correlation of .35262. MOTOR DEVELOPMENT and PREVIOUS EXPERIENCE had the lowest correlation of .23889.

The variable, CORRECT WORDS PER MINUTE, correlated most highly with MOTIVATION with a coefficient of .05130. The correlations of MOTOR DEVELOPMENT and PREVIOUS EXPERIENCE with the dependent variable were nearer to zero.

A comparison of Tables 5 and 6 shows that the interrelations among the independent variables were higher for the control group than for the experimental group. The relationships of the independent variables with the dependent variable were similar for both groups.

Multiple Linear Regression Analysis

Linear multiple regression was utilized to show the relative contribution of the independent variables to the total variance in the dependent variable.

Tables 7, 8, and 9 summarize the findings of a multiple regression analysis of the effects of the independent variables (MOTIVATION, MOTOR DEVELOPMENT, and PREVIOUS EXPERIENCE) on the dependent variable (CORRECT WORDS PER MINUTE). Results of Tables 7 and 8 will give an indication of the relationships between the independent variables and the dependent variable. The relationships found in these tables are not expected to be correlated due to the fact that the matrix showed that each independent variable had low correlation with CORRECT WORDS PER MINUTE.

Tables 7 and 8 present a forward stepwise multiple linear re-
gression analysis. This analysis takes into consideration each of the
independent variables and orders them in the regression equation
according to their relative explanatory power with respect to the
dependent variable. This ordering is reflected in the R^2 column of the
tables.

The variables in Tables 7 and 8 are shown in a stepwise ordering.
The steps indicate the amount of variance each independent variable
has on the dependent variable. Step 3 shows the variable contributing
the greatest amount to the explained variance in the dependent variable.
Step 2 shows the variable contributing the second greatest amount to
the variance. Step 1 indicates which variable contributed the least.

The F statistic is a ratio of explained to unexplained variance
that takes into consideration both the sample size and the number of
variables. The ratio thus obtained provides a basis for determining
the probability of the occurrence happening by chance alone. In Tables
7 and 8 an F is shown for each of the variables, and an overall F is
given for the variables combined.

The significance column shows the probability of the occurrence
happening by chance alone for each individual variable. The overall
significance shows this probability for all the independent variables
combined.

Multiple R is a coefficient that indicates the relationship
between a set of scores predicted from the independent variables and
actual measured scores. The coefficient range is from -1 to +1.
In this study three independent variables were used to predict
CORRECT WORDS PER MINUTE.

The Simple R indicates the effect of each independent variable on the dependent variable. The Simple R is an individual measure of each variable without the influence of any of the other variables.

In the R^2 Change column, each independent variable's effect on the dependent variable is shown, but while the other variables are held constant, they still have some interacting effect. These R^2 Change percentages are shown as cumulative correlations in the R^2 column. The R^2 coefficient tells the proportion of the total amount of variation that is explained by the independent variables.

Table 7, on the following page, is a multiple linear regression with the independent variables (MOTIVATION, MOTOR DEVELOPMENT, and PREVIOUS EXPERIENCE) and the dependent variable, CORRECT WORDS PER MINUTE for the experimental group.

On the first step of Table 7 MOTOR DEVELOPMENT was utilized. It had a simple correlation to CORRECT WORDS PER MINUTE of .00708. This low correlation with the dependent variable produced an R^2 of only .00005, which, of course, is not significant. This variable added .00005 to the explained variance.

During the next step MOTIVATION was added. It obtained a simple correlation with the dependent variable of -.01829. Note that during the selecting of which variable is most important, whether the correlation is negative or positive does not matter. The cumulative effect of MOTOR DEVELOPMENT and MOTIVATION is .00041 as shown in the R^2 column. This correlation is not significant.

TABLE 7

FORWARD STEPWISE MULTIPLE LINEAR REGRESSION ON
CORRECT WORDS PER MINUTE FOR THE <u>EXPERIMENTAL</u> GROUP

Variable	F	Signi-ficance	Multiple R	R^2	R^2 Change	Simple R	Overall F	Overall Signi-ficance
Step 1 Motor development	.0155	.901	.00708	.00005	.00005	.00708	.1336	.940
Step 2 Motor development + Motivation	.0152	.903	.02030	.00041	.00036	-.01829		
Step 3 Motor development + Motivation + Previous experience	.3817	.540	.09294	.00864	.00823	.08992		

During step 3 PREVIOUS EXPERIENCE was added. Its Simple R was .08992. The percentage of variance explained by this variable was .00823. The cumulative effect, then, of all three variables on CORRECT WORDS PER MINUTE was .00864, which is not significant.

The Multiple R column in Table 7 shows that the multiple regression coefficient with only MOTOR DEVELOPMENT as the independent variable is close to zero which means there is almost no relationship between predicted and the actual scores. When MOTIVATION is added to the variable MOTOR DEVELOPMENT, the combined coefficient increased, but the correlation is still quite low with a coefficient of .02030. When the variable PREVIOUS EXPERIENCE is added to the previous two independent variables, the Multiple R increases to .09294.

The significance column shows that for the experimental group the relationship between CORRECT WORDS PER MINUTE with MOTOR DEVELOP-MENT or MOTIVATION would occur about 90 times out of 100 by chance alone, while the relationship between PREVIOUS EXPERIENCE and CORRECT WORDS PER MINUTE would happen about 54 times out of 100 by chance alone. The overall significance of the three variables taken together is .940, indicating that the three chosen independent variables were not good predictors of CORRECT WORDS PER MINUTE on a typing test.

Table 8, on the following page, is a multiple linear regression with the independent variables (MOTIVATION, MOTOR DEVELOPMENT, and PREVIOUS EXPERIENCE) and the dependent variable, CORRECT WORDS PER MINUTE for the control group.

TABLE 8

FORWARD STEPWISE MULTIPLE LINEAR REGRESSION ON
CORRECT WORDS PER MINUTE FOR THE <u>CONTROL</u> GROUP

Variable	F	Signi-ficance	Multiple R	R^2	R^2 Change	Simple R	Overall F	Overall Signifi-cance
Step 1 Motor development	.0438	.835	.00058	.00000	.00000	-.00058	.0975	.961
Step 2 Motor development + Previous experience	.0189	.891	.02524	.00064	.00064	.02436		
Step 3 Motor development + Previous experience + Motivation	.2350	.629	.05691	.00324	.00260	.05130		

On the first step of Table 8 MOTOR DEVELOPMENT was utilized. It had a simple correlation to CORRECT WORDS PER MINUTE of $-.00058$. This low correlation with the dependent variable produced an R^2 of .00000. This variable accounted for none of the variance of the dependent variable.

During step two PREVIOUS EXPERIENCE was added as an independent variable to the computations. It obtained a simple correlation with the dependent variable of .02436. The percentage of variation explained by this variable as shown in the R^2 column was .00064. The cumulative effect of MOTOR DEVELOPMENT and PREVIOUS EXPERIENCE as indicated in the R^2 Change column was .00064. The cumulative effect of MOTOR DEVELOP-MENT as indicated in the R^2 column was .00064. This correlation is not significant.

During step three MOTIVATION was added as an independent variable. Its Simple R was .05130. The percentage of variance explained by this variable was .00260 as indicated in the R^2 Change column. The cumulative effect of all three variables on CORRECT WORDS PER MINUTE was .00324, which is not significant.

The Multiple R column in Table 8 shows that the regression coefficient increased as each independent variable was added. The overall Multiple R was .05691, which indicates that when all three independent variables are added to the computations, their ability to predict the dependent variable was only .05691, which is very low.

The significance column shows that for the control group the relationship to CORRECT WORDS PER MINUTE of MOTOR DEVELOPMENT and PREVIOUS EXPERIENCE would occur about 83 and 89 times out of 100

respectively by chance alone, while the relationship between MOTIVATION and CORRECT WORDS PER MINUTE would happen about 63 times out of 100 by chance alone. The overall significance of the three variables taken together is .961, indicating little could be inferred about the predictability of the dependent variable by the independent variables.

Table 9 is a summary of the results of Tables 7 and 9 and points out the overall Multiple R, R^2, F, and significance levels of the experimental and control groups. The table shows that the Multiple R of the experimental group of .0929 was shown to be higher than the control group, which shows a Multiple R of .0569. These multiple regression coefficients, however, were shown not to be significant.

The strength of the regression of the independent variables on the dependent variable (R^2) for the experimental group is .0086 and for the control group, .0032, indicating that little variance of the dependent variable was accounted for by the independent variables of either the experimental group or the control group.

TABLE 9

OVERALL MULTIPLE REGRESSION OF ALL INDEPENDENT VARIABLES ON
CORRECT WORDS PER MINUTE FOR EXPERIMENTAL AND CONTROL GROUPS

Group	Multiple R	R^2	F	Signi- ficance
Experimental	.09294	.00864	.1336	.940
Control	.05691	.00324	.0975	.961

Neither regression analysis was found to be significant·at a level which could be accepted.

Student's t-Statistic Analysis

Tables 10 through 12 present the individual comparison of means for the various cells of the experimental design employed in this study. The statistical technique used for this comparison is the Student's t-test. The t-test is statistical comparison of means which takes into account the deviations about the mean and using as its coefficient standard the proportions of the normal curve. Higher t-values (whether negative or positive makes no difference) indicate greater differences in means. These differences are then interpreted in conjunction with levels of significance, that is, probabilities of the differences occurring by chance alone.

TABLE 10

t-TEST OF CORRECT WORDS PER MINUTE MEANS OF PRE-
TEST AND POSTTEST OF THE EXPERIMENTAL GROUP (N=25)

Group	Mean	Standard Deviation	Standard Error	Value	DF	2-Tail Prob.
Pretest	5.72	2.574	.5.5	-15.40	48	.000
Posttest	29.40	7.246	1.449			

In Table 10 the difference in means shows an increase in CORRECT WORDS PER MINUTE from pretest to posttest of 23.68. The standard deviation indicates the spread of the two groups, and the standard

error indicates how closely the sample resembles the total population. The less the standard error, the less the deviation of the sample from the population. Note that as the means increase, the standard deviation and standard error also increase proportionally. The t-value is -15.40 and shows a very high significance of .000. Thus the students' increase in CORRECT WORDS PER MINUTE from the pretest to the posttest for the experimental group was significant.

TABLE 11

t-TEST OF CORRECT WORDS PER MINUTE MEANS OF PRE-
TEST AND POSTTEST OF THE CONTROL GROUP (N=47)

Group	Mean	Standard Deviation	Standard Error	t Value	DF	2-Tail Prob.
Pretest	5.6809	2.520	.368	-24.12	92	.000
Posttest	32.2340	7.115	1.038			

Table 11 presents the difference in means between the pretest and posttest for the control group. This table shows an increase of 26.5531 CORRECT WORDS PER MINUTE. The t-value is -24.12 and has a significance of .000. Thus the increase in CORRECT WORDS PER MINUTE was significant.

TABLE 12

t-TEST OF MEANS OF POSTTEST SCORES OF
CORRECT WORDS PER MINUTE BETWEEN
EXPERIMENTAL AND CONTROL GROUPS

Group	N	Mean	Standard Deviation	Standard Error	t Value	DF	2-Tail Prob.
Experi-mental	25	29.4000	7.246	1.449	-1.60	70	.114
Control	47	32.2340	7.115	1.038			

Table 12 presents a comparison between the experimental and control groups' posttest CORRECT WORDS PER MINUTE. The difference in means between the experimental and control groups on the posttest was 2.8340, with the control group having higher scores. The comparison of means obtained a t-value of -1.60, which has a significance of .114. This level of significance between the experimental and control group would not normally be accepted, thus it can be said that there is no significant difference between the experimental and control groups on CORRECT WORDS PER MINUTE.

Summary

At the descriptive statistical level none of the means among the variables appear to show large differences between the experimental and control groups. The difference for the dependent variable is less than two words per minute. Each of the independent variables seem to reflect this same low level of difference.

The correlational measure of association among the variables, r, shows the greatest strength between two of the independent variables for both the experimental and control groups, but it is not the same two variables. The experimental group shows an inverse relationship of $r = -.35691$ between PREVIOUS EXPERIENCE and MOTIVATION. In the control group, the strongest association is between MOTOR DEVELOPMENT and MOTIVATION, $r = .35262$. The strongest association with the dependent variable in the experimental group is with PREVIOUS EXPERIENCE, $r = .08992$. The lowest association with CORRECT WORDS PER MINUTE for both the experimental and control groups is MOTOR DEVELOPMENT.

The regression analysis findings reflect the low relationships found in the correlational analysis. Coefficients of explained variance ran quite low.

The explained variation, R^2, for the experimental group is .00864, and for the control group it is .00324. The stepwise regression showed PREVIOUS EXPERIENCE to be the best predictor in the experimental group and MOTIVATION the best predictor in the control group. MOTOR DEVELOPMENT contributed least to the variance in CORRECT WORDS PER MINUTE in both the experimental and control groups. None of the regression coefficients attained a level of significance sufficiently high for rejection of the null hypotheses.

A Student's t-test was used to test the differences in means among cells of the experimental design. Among these of particular interest is the posttest difference in CORRECT WORDS PER MINUTE for the experimental and control groups. These means are 29.40 for the experimental and 32.23 for the control group. The difference is 2.83. The t

associated with this difference is 1.60. This level of significance

associated with this level of t is .114.

Chapter 5

SUMMARY AND RECOMMENDATIONS

Summary

This study represents an evaluation of a keyboard simulator that
has been developed to help people more easily and quickly acquire the
basic skill of typewriting.

The typewriter simulator EDU-kee, Model 40/72, developed by Kee,
Inc., is used in this study to test its effectiveness in presenting
the typewriter keyboard in comparison to the conventional classroom
training with a teacher and textbook. Three variables were studied
to test their relationships to typing performance. They were:
(1) PREVIOUS MANIPULATIVE EXPERIENCE, (2) MOTIVATION, and (3) MOTOR
DEVELOPMENT.

The typewriting simulator used in this study was tested over a
period of one semester in Northern High School, Detroit, Michigan.
The experimental group learned the keyboard on the simulator without
the aid of a teacher, and the control group received classroom in-
struction in the traditional manner with no exposure to the machine.

Tests were given during the first few days of class to assess the
subjects' previous experience with activities similar to typewriting,
subjects' level of motor development, subjects' level of motivation,
and subjects' level of typing performance. The initial level of typing

performance served as the pretest score. At the end of the treatment

period of one semester, the level of typing performance was once

again tested. This measure served as the posttest.

· To test the relationship between the independent variables and the

dependent variable, the multiple linear regression technique was

utilized. The t-test was used to test the significance of difference

between posttest scores between experimental and control groups and also

pretest and posttest differences within the experimental and control

groups.

The findings presented, in tabular form, the following information

for both the experimental and control groups:

1. Means and standard deviations of the average of the pretest

and posttest.

2. A matrix of correlation coefficients showing relationships

among the variables.

3. A forward stepwise multiple linear regression analysis

indicating the effect of the independent variables to the dependent

variable in order of their strength.

4. A Student's t-test to measure the difference in means between

the experimental and control groups.

It was found that the control group gained in CORRECT WORDS PER

MINUTE over the experimental group, but not significantly. MOTIVATION

was most highly correlated with CORRECT WORDS PER MINUTE in the

control group, while PREVIOUS EXPERIENCE correlated most highly in

the experimental group.

The independent variables accounted for more of the explained variance in the experimental group than in the control group.

Within the control group, PREVIOUS EXPERIENCE accounted for most of the variance. MOTIVATION was second, with MOTOR DEVELOPMENT explaining the least. Within the experimental group, MOTIVATION explained most of the variance. PREVIOUS EXPERIENCE was second, and again, MOTOR DEVELOPMENT explained the least amount of variance.

Results

Four empirical hypotheses were generated for testing in this study. These hypotheses were stated and tested in the null form. That is, each relationship was tested to determine whether it was greater than what could be expected by chance alone. In Chapter 4 the findings associated with these tests were reported and the corresponding level of significance was reported as it was computed. A single criterion level was not set. In this summary, as a basis of acceptance or rejection of the null hypotheses, a probability level of .05 is assumed. Each null hypothesis, the techniques that were employed for its test, and the results of this test follow.

> H_1: There will be no significant difference in level of typing performance attained by the group using the simulator and the group receiving regular classroom instruction.

This null hypothesis was tested by a Student's t-test of difference in means. The difference in typing performance as measured by CORRECT WORDS PER MINUTE was 2.77. The computed t associated with this difference is -1.60. This level of t is not sufficient to reject the null.

H_2: There will be no significant relationship between level of motivation and level of typing performance.

This null hypothesis was tested by a multiple linear regression analysis. The regression coefficient between these variables is $R = -.01829$ for the experimental group and $R = .05130$ for the control group. These levels of association are not sufficient to reject the null.

H_3: There will be no significant relationship between level of motor development and level of typing performance.

This null hypothesis was tested by a multiple linear regression analysis. The regression coefficient between these variables is $R = .00708$ for the experimental group and $R = -.00058$ for the control group. These levels of association are not sufficient to reject the null.

H_4: There will be no significant relationship between level of previous manipulative experience and level of typing performance.

This null hypothesis was tested by a multiple linear regression analysis. The regression coefficient between these variables is $R = .08992$ for the experimental group and $R = .02436$ for the control group. These levels of association are not sufficient to reject the null.

Conclusions

1. The method of learning the keyboard, whether with the simulator or through regular classroom instruction, was unimportant.

2. MOTIVATION, as measured, had no effect on level of typing performance.

3. MOTOR DEVELOPMENT, as measured, had no effect on level of typing performance.

4. PREVIOUS MANIPULATIVE EXPERIENCE, as measured, had no effect on level of typing performance.

5. The variables MOTIVATION, MOTOR DEVELOPMENT, and PREVIOUS EXPERIENCE were not good predictors of CORRECT WORDS PER MINUTE when taken either singularly or combined.

Recommendations for Further Research

A restudy of the design by this researcher reveals one particular weakness that should be taken into account in any subsequent research. In the design of this research initial testing was done very early, while testing for effect was done much later in the treatment time period. From field observation, it was noticed that both teacher and student interest was initially very high. Then, as the weeks progressed, this interest dropped off. By the end of the predetermined test period, interest shown by both teachers and students was much lower than at the first.

It is possible that initial learning on the simulator was high, but without the necessary follow through, these effects disappeared.

It is recommended, therefore, that further studies test for effect much more often. Research attempts should be made to determine curve differences in learning rates between the simulator and non-simulator teacher methods. It may be possible that the ascentote of the learning curve is reached more quickly with the simulator.

Classroom teacher: If the classroom teacher were to either promote or, on the other hand, de-emphasize the use of the simulator, it might make a great deal of difference in the assessment. The use of the simulator constitutes a break in the classroom teacher's usual procedure and therefore, special effort or interest would be required to keep a sustained effort over a time period as extensive as a semester.

It is recommended, therefore, that further research either carefully control for classroom teacher differences or provide some incentive to maintain the interest and effort of the classroom teacher over the selected time period.

Actual clock time: In this study the actual amount of time spent on the simulator by each student was not taken into consideration. If it had been, there might be some basis for determining what type of students are more likely to gain by working on the simulator. It is possible that either the very fast or the very slow learners stand to gain from work on the simulator. The classroom teacher, particularly, might find this information of value.

It is, therefore, recommended that further research on the simulator include some record of how much time each subject spends on the device. This recording procedure might be accomplished by simply providing a sheet for signing in and signing out for each machine.

Long-range effects: Since the Hawthorne studies conducted at Western Electric Company in the early thirties, researchers have known about the gimmick effect that can occur with the introduction of any change. A machine such as the typewriting simulator in this study

with its lights and tape feed might be particularly susceptible to an early fascination that would quickly wear off.

It is, therefore, recommended that some further research on the device take into account long-range changes in teacher and subject attitude toward the machine.

Apart from any Hawthorne or gimmick effect there may be differences in learning rates by use of the machine that are not sustained. The answers to such questions as this could only come through longer-range or follow-up studies.

Sample: Due to last-minute changes in the original field design, the sample size was cut to a marginal level. In order to be able to generalize the conclusions of this study to the population, the sample size should be increased.

It is recommended, therefore, that further research employ random sampling utilizing a much larger sample size.

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APPENDICES

APPENDIX A

QUESTIONNAIRE USED TO OBTAIN DATA ON
VARIABLES <u>MOTIVATION</u> AND <u>PREVIOUS EXPERIENCE</u>

1. Why I am taking typewriting

2. Experience I have had similar to typewriting

    _____Piano

    _____Number of years _____

    _____Other musical instruments

    Number of years _____

    _____Work or hobbies requiring use of fingers and hands

    Describe _____

    _____

    Number of years _____

3. I would rate my enthusiasm for learning to type as

    _____ very enthusiastic

    _____ somewhat enthusiastic

    _____ somewhat unenthusiastic

    _____ very unenthusiastic