1996

Impact of Computer-Aided Instruction on Keyboarding Competency

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IMPACT OF COMPUTER-AIDED INSTRUCTION ON KEYBOARDING COMPETENCY

A Study Presented to the Graduate Faculty
of the Department of
Occupational and Technical Studies
Old Dominion University

In Partial Fulfilment
of the Requirements of the Degree of
Master of Science in Education

by
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July 1996

SIGNATURE PAGE

This research paper was prepared by Janet B. Rubin under the direction of Dr. John M. Ritz in OTED 635, Methods of Research. It was submitted to the Graduate Program Director as partial fulfilment for the requirements for the Master of Science in Education degree.

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CHAPTER I

INTRODUCTION

The climate for educational financial support for public schools is shifting and a critical examination of what successfully prepares students for gainful employment is imperative. Technological advancements have created a need for proficient keyboarding skills, and the current methods of instruction are not meeting the needs of the students. Antiquated methods of instruction must be updated to meet the needs of a variety of students that seek keyboard mastery. The instructor can guarantee that a computer keyboard will be a part of the majority of career choices in today's job market. Computer-aided instruction can provide an effective aid to the teacher in the facilitation of learning. "This process recognizes that people change at different rates and that it is not necessary for everyone to change in the same way or at the same time" (Fraser, 1993, p. 19). The researcher's concerns for the impact of outdated methods of instruction, on the technological preparedness of our students, lead to an experimental research project in coordination with a teacher at Maury High School. Students at Maury learn keyboarding by using IBM compatible hardware, WordPerfect 6.0 software, and a computer instruction method developed by Glencoe Publishers. In contrast, students at Granby High School learn keyboarding on electronic typewriters with textbook instruction. The changing nature of the educational population has brought about a "rediscovery" by younger teachers of the age-old concept of individualized instruction (Robinson, 1979, p. 28). Computer-aided instruction of keyboarding provides a learning environment that is flexible to the progress of each student.

While researching the topic of keyboarding instruction, it became evident that technology has had an extensive impact on effective instructional methods. The computer keyboard is such an intricate part of our environment that a much more diverse population of students is seeking instruction. Today a student no longer views the keyboard as part of a typewriter on which to type their reports, but rather as the key to global communication and career preparedness. To prepare students for technological change and the workplace must become a prime concern of business educators.

Statement of the Problem

The problem of this study was to evaluate the impact of computer-aided instruction on whether keyboarding students achieve higher results in the areas of speed and accuracy on competency-based timed writing tests.

Hypothesis

H_1: Keyboarding I students learn to be more proficient at keyboarding for speed and accuracy when using computers and a keyboarding instruction computer software package as compared to instruction provided by typewriters and textbooks when measured by Norfolk Public Schools competency-based timed writings.

Background and Significance

"Social need for industrial education developed in relationship to the economy of the nation. As industrial development proceeded to become the dominant factor in the economic life of America, its educational implications commanded attention" (Barlow,

1990, p. 22). This historic statement is still valid. The economic need of computer knowledge is relevant to future workers. The individual that cannot produce an accurate document in a timely manner, on a computer, is handicapped in the business world of today. There exists a demand for keyboarding skills at all levels of employment. It is the job of business educators to provide computer keyboarding knowledge in a relevant and applicable manner.

Many educational implications of keyboarding instruction include: (1) whether or not business teachers will continue to teach this skill; (2) at what point in the educational process will the skill be taught, and (3) is the present method of instruction producing a proficient student. "Authorities are in general agreement that students should be taught touch keyboarding just before they are required to utilize the skill for composition or sentence typing. Third or fourth grade has become a common placement of formal keyboarding instruction" (Russell, 1994, p. 2). Therefore, keyboarding instruction is occurring at the elementary level in many school systems due to the recognition that students must be able to utilize the computer as a tool early in their educational process. The issue of when keyboarding should be taught will not be addressed in this study; this experiment focuses on the appropriate method and equipment business educators should use to produce a keyboarding student with the skill and accuracy to use this tool effectively.

"Keyboarding can no longer be perceived merely as a course for those pursuing a secretarial/clerical goal. It is an essential enabling skill for all students and all workers" (Toppe, 1991, p. 24). Typewriting, historically viewed as preparation for office

employment, has developed into a global keyboarding requirement to succeed in the technological environment of today's business world.

> "What once was an exclusive function of the secretarial staff has crossed over into the executive realm of an organization . . . executives are discovering they can be more productive by keying in information at a computer terminal rather than dictating that same information to a secretary" (Roderick, 1987, p. 35).

There are many contributors to the transformation of typewriting into keyboarding instruction. The major factor is the advent of technology and the use of the computer in all facets of the workplace. "Students need most of their training on the machines with which they will ultimately work, in order to provide the greatest possible amount of transfer from the learning situation to real life. Those machines are indisputably microcomputers" (Davidson, 1991, p. 33). Instructors must recognize the instructional impact of this technological advancement. Many instructional strategies have become antiquated, and with a more diverse student population seeking keyboarding instruction, individualized needs and levels of progress must be addressed.

The significance of this study lies in the fact that business educators must maintain relevant instructional methods of keyboarding skills to warrant their inclusion in the business education curriculum. "We must be active in convincing students, parents, administrators, and even fellow teachers that keyboarding is an important skill and should remain a major component of the business education curriculum" (Wiggs, 1993, p. 30). If business educators do not adjust their instruction and strategies to keep abreast of employment needs in industry, there exists the danger of maintaining a nonessential curriculum that will be eliminated. In a survey of business professionals, Wentling (1990)

found 23 percent of respondents listed keyboarding skills as a hiring requirement for their open positions (p.16). Evaluating effective teaching tools and providing appropriate state-of-the-art equipped classrooms will result in a credible business education keyboarding course.

Limitations

This research paper was limited to current high school Keyboarding I students at Granby and Maury High Schools, in the Norfolk Public School System, during the fall semester of 1995-96 school year. A morning and afternoon class, comprising of approximately 20 students each, was selected at both locations. Furthermore, the students evaluated in this study were the keyboarding students of two instructors: Mrs. Janet Rubin and Miss Evelyn Williamson. The majority of students in this study had no previous keyboarding instruction, but a few students were involved in a six-week keyboarding course at the middle school level.

Assumptions

During this study, the following assumptions were made:

1. The educational backgrounds of the students were diverse.
2. Students had some previous exposure to a computer and keyboard prior to this course.
3. All students entering the Keyboarding I classes desired instruction in correct keystroking.

Procedures

This is a quasi-experimental study on the impact of computer-aided instruction on student proficiency in Keyboarding I classes. Two urban schools located in Norfolk, Virginia (Granby and Maury High Schools) were chosen. Ms. Evelyn Williamson, a business teacher at Maury High School, agreed to participate in the collection of data by participating in the computer-aided section of the research. Two keyboarding classes (a morning and afternoon class) were selected at each school. The study involved approximately 80 students. Ms. Williamson and the researcher instructed Keyboarding I using the same text and curriculum guide, but the learning environments and method of instruction were different. The Granby High School data was created by students in a traditional class of typewriters with textbook instruction, as opposed to the Maury High School data that was created by students in a computer lab using a computer software package for instruction with the teacher participating as a facilitator. The text used in both classrooms was *Microcomputer Keyboarding and Document Processing*. The text was "specifically designed for use with microcomputers, but the information presented in this instructional program may also be applied if typewriters are used. Information processing skills were developed through a carefully planned, step-by-step process that progresses from simple to complex. It started with learning to operate the computer itself, especially the keyboard, and then continued until the computer could be used as a tool in creating a variety of documents for personal and business use" (Johnson & Stanley, 1995, p. iii). In a conversation with Dr. Johnson, he stated that the development of this integrated text and software package was "market-driven." This instructional strategy

addresses the need to move forward technologically and also allows instructor flexibility to address different learning rates and styles.

The evaluation of the correlation of instructional method and proficient results was measured by the administration of two different three-minute timed-writing tests, with the same syllabic rate. Two different dates were chosen for their administration to ensure the measurement of the entire population and the documentation of speed and error scores for each student. The researcher calculated t-ratios for speed and accuracy and the level of significance at the .05 and .01 levels were evaluated for a one-tailed test.

Definition of Terms

The following terms were routinely used throughout the report and the list of definitions below will clarify their significance to this study.

Computer-aided instruction: information presented to students by means of computer software, student responses are accepted and processed by the computer, and feedback is provided

Keyboarding instruction: correct manipulation of the alphabetic and numeric keys of a typewriter or computer keyboard

Timed writings: text that is measured by "standard typing words" (syllabic rate) to evaluate how many words-per-minute the student can type

Proofreading skill: refers to the ability of the student to read their own typed work to identify errors

Instructional strategies:	methods or procedures used to convey knowledge and concepts to students
Competencies:	exact description of the terminal expectation of student skill after completing instruction

Summary

This study was undertaken to determine specifically if computer-aided instruction of keyboarding resulted in higher student achievement in the areas of speed and accuracy as evaluated by timed-writing tests. The study was conducted in two Norfolk Public High Schools (Maury and Granby); the instructional method used at Maury was computer-aided while at Granby the students learned on Swintec electronic typewriters with textbook instruction. Chapter I provided an introduction, statement of the problem and the hypothesis of this study, as well as an overview of the procedures used. Furthermore, Chapter I addressed the limitations, assumptions, and definitions that related to this study.

Chapter II reviewed the literature that related to the topic of instructional methods that resulted in proficient speed and accuracy skills in keyboarding students. Chapter III provided the exact procedures and methods used in the study. Chapter IV reported the data that was discovered in this study. Chapter V discussed the conclusions that can be drawn from this study and offered potential ideas for future research.

CHAPTER II

REVIEW OF LITERATURE

The goal of this study was to collect and analyze data related to the impact of computer-aided instruction on terminal competencies of Keyboarding I students in the areas of speed and accuracy. In order to understand the study, it was necessary to review certain topics prior to reviewing and evaluating the data collected in the study.

The Review of Literature focused on several issues. The researcher reviewed pertinent literature and investigated the importance of keyboarding as a preparation for work skill, the role of the instructor in facilitating student proficiency, and the impact of computers on the educational environment. A summary concludes the chapter titled Review of Literature.

Keyboarding as a Preparation for Work Skill

"Vocational educators are constantly striving to prepare students for the tasks and responsibilities they will face on the job. This is an especially challenging task in the office systems area with the rapidly changing requirements of the workplace. It is essential for educators to stay up-to-date with new technologies and to collaborate with business and industry in an attempt to prepare students for the workplace" (Davis, 1992, p. 13).

The average salary for secretaries in 1992 was $26,700. Salaries vary a great deal, however, reflecting differences in skill, experience, and level of responsibility, ranging from $20,000 to $36,000 (Occupational Outlook Handbook, U.S. Department of Labor, 1994-95 Edition). These salaries reflect the administrative support area of employment opportunities, but there are many positions that require the efficient use of a keyboard for

word processing and numerical manipulation. Managerial and human resources professionals recognize the value of proficient keyboarding skills. "Management students should be viewed as needing specific skills which are not necessarily the same as those traditionally taught for secretarial students" (Sox, 1988, p. 29). The number of related occupations that require keyboarding proficiency are too numerous to mention and the impact on annual income is hard to measure, but the computer is at the heart of the information processing era.

Keyboarding skills have an expansive impact on the employment market of the future. "More than 9.2 million workers in United States telecommute, a number expected to triple in the next 15 years" (Piskurich, 1996, pp. 22-23). This employment wave of the future will require keyboarding skills that promote efficient use of this method of communication between home and office.

The post-World War II period has witnessed a tremendous shift in the occupational composition of the U.S. economy. The growth of certain types of occupations and the decline of others has changed the probability that members of the labor force will encounter certain types of tasks at their jobs. Activities that involve analysis and communication of data will continue to increase. Technology represents the knowledge of how to produce certain desired products, and encompasses the tools and organization required to bring about that production. Organizations adopt new technologies over time to increase productivity. As an explanation for shifts in the relative size of occupations, technology is argued to have a direct effect on the organization of work and the type of workers required (Szafran, 1996, pp. 54-59). Students seeking

computer-aided keyboarding instruction are preparing themselves with a skill and familiarization of a technological tool that will impact their ability to transfer those skills to current workforce requirements.

> "Criticism of education has been mounting during the past decade. Business and labor are questioning the public education system's ability to prepare students to perform in a global economy, to help U.S. industries regain a competitive edge, and to adapt quickly to new and emerging technologies. To facilitate this process keyboarding and computer literacy skills have been identified as essential basic skills." (Illinois State Council on Vocational Education, 1991, pp. 6-11)

The Role of the Instructor

Educators play a key role in developing the computer-literate citizen of the future, and therefore need to reexamine some traditional attitudes and priorities in relation to relevance, access, timing and teaching methods for computer keyboard skills. Keyboard proficiency, which facilitates the efficient input and retrieval of text and data is needed by everyone in today's technologically advanced society. Allowing students simply to 'pick up' the keyboarding skill leads to bad habits which are notoriously difficult to correct later (Gillmon, 1991, pp. 4-13).

Mary S. Willis, assistant professor at Valdosta State College, conducted a survey of secondary business educators in Georgia to find out the impact of computers on their instruction of keyboarding:

> Nearly 25 percent of the respondents use only typewriters to teach keyboarding. Computer use is increasing, especially in schools with enrollments of 1,000 or more.

Forty-three percent use only computers to teach keyboarding.

Thirty-two percent use both typewriters and computers.

Willis encourages business teachers to strive for updated supplies and equipment lest they graduate students who are 'ill-prepared to function satisfactorily in the workplace' (1994, p. 15).

Evaluative studies of instructional methods are important, but their implementation will be heavily impacted by the effectiveness of the instructor. The role of business teachers in the delivery of computer-related instruction is at the crux of the strength of business education. The business educator must participate in continuous technical and professional development programs to insure that their instructional theory and process are relevant to actual 'real-life' world applications (Schmidt, 1988, p. 25).

Impact of Computers on the Educational Environment

At a recent South-Western Publisher's workshop (February, 28, 1996, Tidewater Community College, Portsmouth Campus), the issue was not computer-aided instruction vs. electronic typewriter instruction, but which software provided the best results in the classroom. All keyboard instruction materials were geared toward an IBM compatible computer whether stand-a-lone or on a network. There was a full-range of applications available and as an educator, the researcher focused on the one constraint not mentioned. Will school systems throughout the U.S. find the financial support to provide technology to run these software programs? The software programs on display required enough memory to run Windows and offered options to access the Internet. The business

department at Granby High School has a computer lab of 20 computers, and only four of those computers have the capacity to run Windows. Technological constraints affect the relevant and up-to-date instruction that occurs in the classroom.

When viewing the new instructional materials available, it was apparent that the individuals developing these instructional materials have acknowledged the impact of multi-cultural and interdisciplinary concerns. The materials are reaching for an instructional level well beyond the individual learning 'typing' to pursue a clerical position. The instructional materials included: (1) a component on the numeric keypad to familiarize the student with the correct keystroking of a numeric keypad when working on computational exercises or spreadsheet activities; (2) language arts exercises to ensure the appropriate use of format and grammar; and (3) the explanation and application of a variety of documents, ranging from letters and resumes to invoices and itineraries. The researcher noted that the instructional materials displayed provided interesting and relevant instruction directed toward more complex and integrated business environment requirements.

With a per ponderous amount of instructional software on the horizon, the educator must determine not only the best instructional approach, but at what age to begin instruction. There are many research studies and computer software 'reviews' relevant to instructional methodology and at what point keyboarding instruction should begin. When to instruct keyboarding and how was a parallel issue in many articles. "One of the greatest frustrations for beginning computer students is their inability to enter their ideas into the computer as fast as their brains generate them" (McKinnon, 1988, p. 77). Computer-

aided instruction is a viable tool to teach keyboarding skills to elementary age students with positive results. Providing the student with keyboarding skills, incorporated at the optimum point in their educational process, must be considered. Instructors must also recognize that "it is important that students have the skill to follow various vendor-produced manuals, and word processing and data manipulation concepts, to be adaptable to whatever they find in a company procedures manual" (Dickey-Olson, 1988, p. 33).

CAI (Computer-Aided Instruction) has and will continue to have a major impact on classroom teaching by utilizing drills, tests, tutorial instructions, problem solving situations, and simulations to convey information to the student. Barbara Schultz conducted a study to evaluate instructor-assisted individualized instruction versus computer-assisted individualized instruction. This study was conducted approximately 10 years ago with a population of eleven students and concluded that the combination of computer-aided instruction and the facilitation of instruction by a teacher derives the most positive results in attainment of student mastery at the keyboard (Schultz, 1985, pp. 3-13). Students with varying levels of ability benefit from CAI. This self-paced method of instruction was a great advantage when dealing with different comprehension levels. On average, students learned the required material quicker when information was presented in CAI modules than they did when the material was presented in the traditional lecture format. Computers rarely have an "off" day. Unless the program has been tampered with, its organization assures that the student has seen all of the information presented and has successfully answered the questions concerning the topics. The computer taught the

student how to perform a task and then evaluated how well the student performed the task independently (Michigan State University, 1995, pp. 1-5).

Ms. Williamson, the business teacher at Maury High School that instructed the experimental group for this study (1996), commented on the fact that the Keyboarding I curriculum should be revised to accommodate technological advancements because current terminal competencies have been developed for keyboarding manipulation on a typewriter. "Relating features to the student about a typewriter while they are working on a computer was much easier than trying to explain software features to students who were learning on a typewriter. Some electronic typewriters do have some features that the software packages possess, but learning keyboarding skills and document processing with the computer software package creates an environment where students are learning a word processing software package along with word processing skills. Computer-aided instruction of keyboarding requires continuous up-dating of curriculum to address current competencies that are relevant to technological advancements."

Summary

In Chapter II, the Review of Literature provided an explanation of the significance of computer-aided instruction on the educational environment surrounding the development of keyboarding skills. Keyboarding as a preparation for work skill, the role of the instructor in facilitating student proficiency, and the impact of computers on the educational environment was examined. Chapter III will provide the Methods and

Procedures used to compile the data relevant to the impact of computer-aided instruction on the speed and accuracy skills of Keyboarding I students.

CHAPTER III

METHODS AND PROCEDURES

The purpose of Chapter III was to explain the methods and procedures used to obtain data for this quasi-experimental study. Included in this chapter are sections on population, research variables, instrument design, classroom procedures, methods of data collection, and statistical analysis. The information will be interpreted in later chapters to determine the impact of computer-aided instruction on keyboard mastery in the areas of speed and accuracy. A summary is presented at the end of this chapter.

Population

The study consisted of a control group and an experimental group. The study was conducted with high school students in four keyboarding classes, one morning and one afternoon class at two different high schools. These were conducted at Granby and Maury High Schools in Norfolk, Virginia. The study was conducted during the fall semester of the 1995-96 school year. The control group consisted of 36 students instructed in keyboarding skills with course work and typewriters, and the experimental group consisted of 32 students using a computer lab with an instructional software package integrated with WordPerfect 6.0.

Research Variables

The classes at Maury High School were conducted in a computer lab. The equipment used were Compaq Proline 4/50 computers with Compaq 140 monitors. Each computer had a mouse and expanded keyboard. The instructional textbook used both at

Granby and Maury was Microcomputer Keyboarding and Document Processing (1996 edition), published by Glencoe McGraw-Hill. Maury High School keyboarding classes used the software version (KDP6) and the compatible word processing software WordPerfect 6.0.

The classes located at Granby High School were taught in a typing lab. The equipment used were Swintec 4040 typewriters and the same Microcomputer Keyboarding and Document Processing textbook.

Instrument Design and Use

The instruments used to measure the competency of the students in the areas of speed and accuracy were two different three-minute timed writings with the same syllabic rate. The timed writings were administered on two different days within the last week of the semester to ensure the measurement of the entire population. The timed writings were administered by the instructors and clocked on a certified timer. Each student proofread their timing, circled their errors, and documented their words-per-minute processed. The instructors collected the timed writings and verified each score making corrections when necessary. The timed writings used were developed by Glencoe Publishers. Glencoe developed the textbooks used in both high schools and the software used in the experimental group. The instrument was administered for exactly three minutes. Students stopped at the sound of a bell and either removed their papers from their typewriters or printed their timed writing on a printer. A sample of the instrument is included in Appendix A.

Classroom Procedures

Instructional methods were different in the control group at Granby High School and the experimental group at Maury High School. The students in the control group received daily instruction by the teacher, one lesson at a time, with textbook support. The students in the experimental group received primarily individual instruction as the students progressed at the own pace using the Glencoe Instructional Software (Microcomputer Keyboarding and Document Processing).

Methods of Data Collection

During the week of January 22-26 each instructor administered two different three-minute timed writings to each of their classes on two separate days. This provided the instructors with the best opportunity to collect proficiency readings in the areas of speed and accuracy for each student. A student, not present for the timed-writing on one day, had the opportunity to have their competency measured during the second testing. Each student's best score for speed and their lowest error rate was used to tabulate the findings.

Statistical Analysis

The resulting scores, from the three minute timed-writings of the control and experimental groups, were statistically analyzed using a t-test for both speed and accuracy. The best speed and accuracy score for each student on a three-minute timed writing was used to calculate the sample means. The sample means of the experimental and control group and values

of a t-test for a one-tailed test were used to determine significance. The researcher calculated the t-ratio for speed and accuracy using the following statistical formula:

$$t = \frac{M_1 - M_2}{\sqrt{\left(\frac{\Sigma d_1^2 + \Sigma d_2^2}{N_1 + N_2 - 2}\right)\left(\frac{N_1 + N_2}{N_1 \times N_2}\right)}}$$

The degree of freedom ($N_1 + N_2 - 2$) was determined and level of significance for a one-tailed test at the .05 and .01 levels was ascertained for each of the results.

Summary

In this chapter, a description of the methods and procedures used to collect data for this study were described. The population, research variables, instrument design, classroom procedures, methods of data collection, statistical analysis, and the summary were reviewed. In Chapter IV, findings of data collected were presented and conclusions and recommendations were discussed in Chapter V.

CHAPTER IV

FINDINGS

The purpose of this study was to determine if a correlation existed between the type of instructional method used to convey keyboarding competencies and student proficiency in the areas of speed and accuracy. The study measured the results in the areas of speed and accuracy for a control group using traditional instruction with typewriters and textbooks and an experimental group that received their instruction in a computer lab using computer-aided instruction. The findings were used to substantiate or refute the following hypothesis: Keyboarding I students learn to be more proficient at keyboarding for speed and accuracy when using computers and a keyboarding instruction software package, as compared to instruction provided by typewriters and textbooks when measured by Norfolk Public Schools competency-based timed writings.

Analysis of Data

The findings were based on data collected from 68 keyboarding students at Granby and Maury High Schools. The students participating in this study were enrolled in Keyboarding I classes during the first semester of the 1995-96 school year. They were identified by grade level (ranging from 9 through 12), race, and sex. Their timed-writing results were documented accordingly (See Appendix B). The average speed scores, for the experimental group (M_1) and control group (M_2), were 23.63 and 25.77 respectively (See Appendix C), and the t-ratio was found to be 1.11 (See Table 1). Accuracy was measured using a range of one to five errors during a three-minute timed-writing test. The

average error-rates for the experimental group (M_1) and control group (M_2), were 2.78 and 3.08 respectively (See Appendix E). The t-ratio was calculated for accuracy and was found to be .67 (See Table 2). The researcher calculated the t-ratios using the following formula:

$$t=\frac{M_1-M_2}{\sqrt{\left(\frac{\Sigma d_1^2+\Sigma d_2^2}{N_1+N_2-2}\right)\left(\frac{N_1+N_2}{N_1\times N_2}\right)}}$$

The mathematical computations for speed are shown in Appendix D, and the mathematical computations for accuracy are shown in Appendix F.

Table 1
Speed Averages for the
68 Keyboarding I Students in this Study

Variable	Set 1* Mean	Set 2* Mean	T-Ratio
Speed	23.63	25.77	1.11

*Set 1=Average Scores for the Experimental Group
**Set 2=Average Scores for the Control Group

Table 2
Accuracy Averages for the
68 Keyboarding I Students in this Study

Variable	Set 1* Mean	Set 2* Mean	T-Ratio
Accuracy	2.78	3.08	.67

*Set 1=Average Scores for the Experimental Group
**Set 2=Average Scores for the Control Group

Summary

Chapter IV documented the results of speed and accuracy data collected from 68 students (32 participating in an experimental group with computer-aided instruction and 36 participating in a control group with traditional typewriter instruction). Two t-tests were performed. The results of the t-test on speed scores for a three-minute timed-writing test was 1.11 and the results of the t-test on accuracy was .67. Tables 1 and 2 show the means for the experimental and control groups and the resulting t-ratios for speed and accuracy. The summary, conclusions, and recommendations of this study are found in Chapter V.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem of the study was to evaluate the impact of computer-aided instruction on whether keyboarding students achieve higher results in the areas of speed and accuracy on competency-based timed writing tests. This chapter summarizes the study, draws conclusions based on the findings, and recommendations are made for further study.

Summary

This study recognized the value of keyboarding skill and evaluated the most proficient method with which to develop this skill with speed and accuracy as desirable results. The study was conducted to determine if instructional methodology, specifically computer-aided instruction, enhanced student keyboarding proficiency in the areas of speed and accuracy. The researcher acknowledged the impact of technology on business education and future keyboarding curricula and sought to determine if computer-aided instruction produces better speed and accuracy results in students completing their first semester of keyboarding instruction.

This quasi-experimental study was conducted during the 1995-96 school year in two high schools located in Norfolk, Virginia. Four Keyboarding I classes were used to conduct the study. The experimental group consisted of two classes (a.m. and p.m.) at Maury High School and the control group consisted of two classes (a.m. and p.m.) at Granby High School. The experimental and control groups used the same text *Microcomputer Keyboarding and Document Processing* and curriculum guide. The experimental group learned keyboarding proficiency on computers with the

Microcomputer Keyboarding and Document Processing software package running in conjunction with WordPerfect 6.0. The control group learned on Swintec typewriters with traditional textbook instruction. A total of 68 keyboarding students participated in the study, 32 in the experimental group and 36 in the control group. The data was compiled from the administration of two three-minute timed writing tests, documenting the best speed and error scores for each student. T-test ratios were calculated for speed and accuracy and the level of significance for a one-tailed test at the .05 and .01 levels were evaluated.

Conclusions

H_1: Keyboarding I students learn to be more proficient at keyboarding for speed and accuracy when using computers and a keyboarding instruction computer software package as compared to instruction provided by typewriters and textbooks when measured by Norfolk Public Schools competency-based timed writings. Based on the data collected from 68 students attending Granby and Maury High Schools a t-ratio was calculated. The t-test results for speed was 1.11 and did not exceed the .05 level on the table of critical values for a degree of freedom of 66. The t-ratio results for accuracy were .67 and did not exceed the .05 level. Based on these significant values the researcher must reject the hypothesis (See Appendix G). There was no significant impact on the proficiency of Keyboarding I students in the areas of speed and accuracy based on the results of competency-based timed writings.

Recommendations

1. This study was completed with 68 Keyboarding I students. Future studies should incorporate a larger population and be conducted after a full-year of keyboarding.
2. A follow-up study should be conducted to evaluate the impact of computer-aided instruction on career preparedness and the link between the ability to apply computer software concepts and success in the business world. Preparing students for living and working in the technological environment of today requires the integration of computer-aided instruction into business education courses. The long range impact of limiting instruction of keyboarding to typewriter manipulation, is a student handicapped in a world that requires global communication skills to adequately tap the "information highway." The measurements of speed and accuracy after one semester of instruction were not significant, but the evaluation of a student entering the world of work without computer knowledge and that correlation to employability may be very significant. The researcher believes that students equipped with proficient keyboarding skill and computer software knowledge have broadened their career opportunities.
3. An important issue, that has an impact on the future of instructional trends, is the financial constraint of providing current state-of-the-art equipment to instruct future employees. Future studies need to focus on the budgeting constraints of school systems that are attempting to finance the continuous process of updating software and hardware required to provide relevant instruction.

4. Additional research should be conducted to evaluate the motivation level of students participating in the self-paced learning environment of computer-aided instruction. Instructional computer software packages provide a learning format of sequenced information and immediate feedback on performance that does not exist in the traditional lecture style classroom. This method provides the instructor/facilitator flexibility, allowing individual students to repeat exercises to ensure comprehension of the concept.

5. The effectiveness of computer-aided instruction must be evaluated in conjunction with student success when entering the work world or pursuing further education at the college or university level. The researcher notes that very few typewriters are found in these environments. Students pursuing secondary education at the college or university level will find computers that require word processing software knowledge to produce documents. Sole instruction on a typewriter will create a student without software production capabilities necessary to succeed in the educational and work environments.

6. Although students are as proficient after the first semester, a further study will note that courses in the business education curriculum are being converted to computer instruction. Therefore, software knowledge is essential for students to be proficient in the 'real world'.

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APPENDICES

APPENDIX A

3-Minute Timed Writing Tests Used For Evaluation

Timings

Scales are provided for 1- and 3-minute timings. Speed markers are provided for 5-minute timings.

Timing 1

		1'	3'
1	Raising dogs can be a combination of both fun and hard	12	4
2	work. Before you even start, you have to decide just which	24	8
3	breed can best adapt to your life-style. If you need a dog	36	12
4	to protect your house, a dachshund will not give you enough	48	16
5	protection. If you are in your own apartment, a collie may	60	20
6	be too large. When you have chosen the dog for you, expect	72	24
7	to have to train it. This can be done quickly with a zesty	84	28
8	puppy that is willing to learn.	90	30

Timing 2

		1'	3'
1	For students who can speak a foreign language, there's	12	4
2	an amazing job market today. Numbers of major companies in	24	8
3	other countries have been buying control of or investing in	36	12
4	American businesses. Their demand for workers with foreign	48	16
5	language skills can be seen in the increased number of help	60	20
6	wanted ads for experts with language skills.	69	23
7	The fact that so many Americans cannot speak, read, or	81	27
8	write another language is very tragic because the countries	93	31
9	of the world today are closely linked. International trade	105	35
10	is vital to business and government today, and young people	117	39
11	cannot afford to be unequipped to meet the challenge of the	129	43
12	future.	130	44

APPENDIX B

Student Identification By Grade Level, Race, and Sex

and

Timed Writing Results For The Experimental and Control Groups

Maury High School Results

MAURY HIGH SCHOOL/EXPERIMENTAL GROUP									
BELL 2 A.M.					BELL 6 P.M.				
Student #	R/S	GD	#1	#2	Student #	R/S	GD	#1	#2
1	BM	10	16/4	19/3	1	WF	11	30/1	38/2
2	WM	9	17/3	17/1	2	WF	12	43/1	47/0
3	WF	12	25/5	14/5	3	BF	9	20/3	N/A
4	BM	11	17/4	17/3	4	WM	10	24/2	23/2
5	WF	9	13/5	23/1	5	BM	9	26/5	15/5
6	AF	9	29/3	27/1	6	WM	12	32/3	29/1
7	WF	12	22/3	23/3	7	WF	9	12/2	22/3
8	WF	12	23/4	26/2	8	WF	9	20/5	28/5
9	BM	9	19/5	N/A	9	BF	9	27/5	32/5
10	BF	12	19/0	23/4	10	BM	10	13/5	22/2
11	HM	11	36/3	44/0	11	BF	9	11/1	N/A
12	BM	10	21/3	29/3	12	WF	12	16/5	18/5
13	BM	10	N/A	20/5	13	BF	9	20/5	19/5
14	WF	11	N/A	40/0	14	BM	9	15/1	16/0
					15	BF	9	11/5	15/5
					16	BF	9	14/5	16/5
					17	WM	11	8/5	9/5
					18	BF	10	10/5	N/A

Granby High School Results

GRANBY HIGH SCHOOL/CONTROL GROUP									
Bell 3 A.M.					Bell 5 P.M.				
Student #	R/S	GD	#1	#2	Student #	R/S	GD	#1	#2
1	BM	10	23/4	22/5	1	WM	11	22/5	24/1
2	AM	9	24/3	25/3	2	WF	10	20/1	20/5
3	WM	9	28/5	N/A	3	AF	9	25/5	N/A
4	WF	11	31/5	35/3	4	BF	9	12/5	13/4
5	WM	12	N/A	21/5	5	BM	10	34/5	27/5
6	WF	10	27/2	26/5	6	BM	11	27/5	20/5
7	BF	10	22/3	21/3	7	BM	10	12/2	N/A
8	WF	9	37/3	38/3	8	WM	10	27/2	23/1
9	BM	9	21/5	20/5	9	WF	11	33/5	37/4
10	AF	9	27/5	25/5	10	WM	9	21/3	26/2
11	WM	10	28/5	35/5	11	WF	9	29/4	30/4
12	BF	10	14/5	N/A	12	WF	9	32/3	28/5
13	BF	11	24/4	26/1	13	BM	10	20/3	24/4
14	BF	12	24/0	24/2	14	WM	10	31/4	32/4
15	BF	10	21/4	25/2	15	AM	11	20/1	N/A
16	BF	11	19/0	21/4	16	WM	12	32/3	32/3
17	WF	10	20/2	18/4	17	WM	10	27/5	29/5
18	BF	9	30/5	28/5					
19	BF	9	22/0	21/5					

APPENDIX C

Speed Calculations

SPEED CALCULATIONS

		SPEED CALCULATIONS							
SET 1/EXPERIMENTAL			SET 2/CONTROL						
32 PARTICIPANTS			36 PARTICIPANTS						
19	-4.63	21.44	23	-2.77	7.67				
17	-6.63	43.96	25	-0.77	0.59				
25	1.37	1.88	28	2.23	4.97				
17	-6.63	43.96	35	9.23	85.19				
23	-0.63	0.40	21	-4.77	22.75				
29	5.37	28.84	27	1.23	1.51				
23	-0.63	0.40	22	-3.77	14.21				
26	2.37	5.62	38	12.23	149.57				
19	-4.63	21.44	21	-4.77	22.75				
19	-4.63	21.44	27	1.23	1.51				
44	20.37	414.94	35	9.23	85.19				
29	5.37	28.84	14	-11.77	138.53				
20	-3.63	13.18	26	0.23	0.05				
40	16.37	267.98	24	-1.77	3.13				
38	14.37	206.50	25	-0.77	0.59				
47	23.37	546.16	21	-4.77	22.75				
20	-3.63	13.18	20	-5.77	33.29				
24	0.37	0.14	30	4.23	17.89				
26	2.37	5.62	22	-3.77	14.21				
32	8.37	70.06	24	-1.77	3.13				
22	-1.63	2.66	20	-5.77	33.29				
28	4.37	19.10	25	-0.77	0.59				
32	8.37	70.06	13	-12.77	163.07				
22	-1.63	2.66	34	8.23	67.73				
18	-5.63	31.70	27	1.23	1.51				
20	-3.63	13.18	12	-13.77	189.61				
16	-7.63	58.22	27	1.23	1.51				
15	-8.63	74.48	37	11.23	126.11				
16	-7.63	58.22	26	0.23	0.05				
9	-14.63	214.04	30	4.23	17.89				
10	-13.63	185.78	32	6.23	38.81				
11	-12.63	159.52	24	-1.77	3.13				
756		2645.50	32	6.23	38.81				
	23.625		20	-5.77	33.29				
	M_1=23.63		32	6.23	38.81				
	$D1^2$=	2645.5	29	3.23	10.43				
			928		1394.22				
				$D2^2$=	1394.22				
			25.77778	M_2=25.77					
	M1-M2	-2.14							
	$Ed1^2+Ed2^2$	4039.72							
N1=32	N1+N2-2	66		N1+N2	68		N1*N2	1152	
N2=36									

APPENDIX D

T-Ratio Speed Computations

T-RATIO SPEED COMPUTATIONS

$$t=\frac{M_1-M_2}{\sqrt{(\frac{\Sigma d_1^2+\Sigma d_2^2}{N_1+N_2-2})(\frac{N_1+N_2}{N_1\times N_2})}}$$

$$t=\frac{23.63-25.77}{\sqrt{(\frac{2645.5+1394.22}{66})(\frac{68}{1152})}}$$

$$t=\frac{-2.14}{\sqrt{(\frac{4039.72}{66})(\frac{68}{1152})}}$$

$$t=\frac{-2.14}{\sqrt{(61.21)(.06)}}$$

$$t=\frac{-2.14}{\sqrt{3.67}}$$

$$t=\frac{-2.14}{1.92}$$

$$t=1.11$$

APPENDIX E

Accuracy Calculations

ACCURACY CALCULATIONS								
Set 1/Experimental				Set 2/Control				
3	0.22	0.05		4	0.92	0.85		
1	-1.78	3.17		3	-0.08	0.01		
5	2.22	4.93		5	1.92	3.69		
3	0.22	0.05		3	-0.08	0.01		
1	-1.78	3.17		5	1.92	3.69		
1	-1.78	3.17		2	-1.08	1.17		
3	0.22	0.05		3	-0.08	0.01		
2	-0.78	0.61		3	-0.08	0.01		
5	2.22	4.93		5	1.92	3.69		
0	-2.78	7.73		5	1.92	3.69		
0	-2.78	7.73		5	1.92	3.69		
3	0.22	0.05		5	1.92	3.69		
5	2.22	4.93		1	-2.08	4.33		
0	-2.78	7.73		0	-3.08	9.49		
1	-1.78	3.17		2	-1.08	1.17		
0	-2.78	7.73		0	-3.08	9.49		
3	0.22	0.05		2	-1.08	1.17		
2	-0.78	0.61		5	1.92	3.69		
5	2.22	4.93		0	-3.08	9.49		
1	-1.78	3.17		1	-2.08	4.33		
2	-0.78	0.61		1	-2.08	4.33		
5	2.22	4.93		5	1.92	3.69		
5	2.22	4.93		4	0.92	0.85		
2	-0.78	0.61		5	1.92	3.69		
1	-1.78	3.17		5	1.92	3.69		
5	2.22	4.93		2	-1.08	1.17		
5	2.22	4.93		1	-2.08	4.33		
0	-2.78	7.73		4	0.92	0.85		
5	2.22	4.93		2	-1.08	1.17		
5	2.22	4.93		4	0.92	0.85		
5	2.22	4.93		3	-0.08	0.01		
5	2.22	4.93		3	-0.08	0.01		
89		119.47		4	0.92	0.85		
2.78125				1	-2.08	4.33		
M1=2.78	$D1^2$=	119.47		3	-0.08	0.01		
				5	1.92	3.69		
				111		100.75		
				3.083333				
				M2=3.08	$D2^2$=	100.75		
M1-M2=	-0.3							
	$Ed1^2+Ed2^2$	220.22						
N1=32								
N2=36		N1+N2-2=	66		N1+N2=	68	N1*N2=	1152

APPENDIX F

T-Ratio Accuracy Computations

T-RATIO ACCURACY COMPUTATIONS

$$t=\frac{M_1-M_2}{\sqrt{(\frac{\Sigma d_1^2+\Sigma d_2^2}{N_1+N_2-2})(\frac{N_1+N_2}{N_1\times N_2})}}$$

$$t=\frac{2.78-3.08}{\sqrt{(\frac{119.47+100.75}{66})(\frac{68}{1152})}}$$

$$t=\frac{-0.3}{\sqrt{(\frac{220.22}{66})(\frac{68}{1152})}}$$

$$t=\frac{-0.3}{\sqrt{(3.34)(.06)}}$$

$$t=\frac{-0.3}{\sqrt{.2004}}$$

$$t=\frac{-0.3}{.45}$$

$$t=.67$$

APPENDIX G

Critical Values of t

Table II Critical Values of t

df	Level of significance for one-tailed test .10	.05	.025	.01	.005	.0005
	Level of significance for two-tailed test .20	.10	.05	.02	.01	.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.5771	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.379	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.861	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.717	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690

28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291