The Effects of Initial Touch Keyboarding Speed Achievement of Fifth Graders

and Touch Keyboarding Skill Retention in Seventh Grade

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CHAPTER 1: INTRODUCTION

<u>Introduction</u>

Only a few miles from where this research is being conducted, Christopher Latham Sholes invented the typewriter in 1867. Sholes could not lay out the keys alphabetically because common combinations resulted in the jamming of levers. Today's computer keyboards are not limited by the mechanics of Sholes' invention and although more efficient designs have been made, keyboarding students are learning the reaches of keys placed nearly a century and a half ago.

The importance of keyboarding for elementary children is not questioned. In fact, today training of keyboarding is being included in the elementary curriculum at earlier grades (Rogers, 2006).

One question, however, is should teaching young children keyboard familiarity or keyboard mastery be the goal. Obviously, teaching for mastery requires a greater time commitment in an elementary curriculum that is already tight. Perhaps teaching of keyboarding could be done in place of cursive writing as one researcher suggested (Pisha, 1993).

Another question is how should training be done? Not long ago, business education teachers taught what was then called typewriting to high school students. Now that elementary children as young as first or second grade are learning to key, will training be the responsibility of the classroom teacher?

Voice recognition software is available for inputting text into a computer, but it still has a way to go if it will replace the keyboard as the dominant means of interacting with the computer for elementary students.

Computers are becoming commonplace in both schools and homes. Will children hunt and peck for keys as they input on the keyboard or will they develop a skill that allows them to use both hands and very little cognitive effort as they key. One requires very little training and the other an investment of time that may be hard to find. If an investment of time will be made into training, will students retain this skill as they move on in their education? This study examined the effect of initial keyboard training of fifth graders and their retention in seventh grade.

Statement of the Problem

The purpose of this study was to examine the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade.

Research Question

What are the effects of initial touch keyboarding speed achievement of fifth graders on touch keyboarding skill retention in seventh grade?

Sub Questions

1.   What level of touch speed allowed students to retain and improve their skill?

2.   To what extent is initial touch speed achievement related to seventh grade skill level?

3.   What other factors effected touch speed level two years later?

Research Hypothesis

There is a relationship between initial touch speed achievement of fifth grade keyboarding students and touch keyboarding skill retention in seventh grade.

<u>Null Hypothesis</u>

There is not a relationship between initial touch speed achievement of fifth grade keyboarding students and touch keyboarding skill retention in seventh grade.

<u>Definition of Terms</u>

Touch Keyboarding, for this study, is the use of a keyboard, with a homerow position for the hands and assigned key reach responsibilities for each finger, by feel versus sight. *MicroType* is a software program that provides drill and practice and timing material.

<u>Limitations</u>

1. The survey was designed by the researcher and was not tested for validity or reliability.

2. The sample for this study was limited to students from the researcher's 2007 Keyboarding classes.

3. The accuracy of student responses on the survey may be affected by recall.

CHAPTER 2: REVIEW OF THE LITERATURE

Introduction

The purpose of this study is to examine the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade. Numerous research and articles from the 80's and 90's are evident in a review of the literature. A rising use of computers at the elementary level during this time heightened the need to determine what is an appropriate use and level of keyboarding skill for children. The literature indicates a consensus for the need of keyboarding skills, however, there remains debate as to when and how instruction of this skill is to take place.

The review of the literature is organized into six topics. First, review of keyboarding and its effect on academics is conducted. Second, when to teach keyboarding will be explored. Third, how much keyboarding instruction is needed. Fourth, continued keyboarding usage after training is reviewed. Fifth, the moving from visual keying to operating keys by feel is examined. A sixth topic will serve to present other important findings related to keyboarding that did not fit neatly into the previous categories. Finally, the review of the literature will conclude with a summary of the major findings.

Keyboarding and its Effects on Academics

The importance of keyboarding is not overlooked by students. Students, both male and female, believe being competent with the keyboard and knowing computer applications will help in their education and in finding a job of their choosing (McKinnon and Nolan, 1990). Additionally, students using a "hunt and peck" technique were not

content with this and desired to key more competently (McKinnon and Nolan, 1990). Pisha (1993) commented that hunt and peck typists relied more than touch typists on visual feedback, having to look at the keyboard all the time to guide their fingers. The significance of this for academics is the hunt and peck typist, compared with a similar individual who has learned ten-finger technique, will be required to use more cognitive resources to physically produce their thoughts leaving less cognitive resources for their thought process when writing (Pisha, 1993).

Research has shown mixed results on whether or not word processing improves writing. In a study of sixth graders, many who had received two-and-a half years of keyboarding instruction, there was no reported difference in the overall quality between pencil-and-paper compositions and word processed compositions. More words however, were written in the word-processed writings (Nichols, 1996).

In the comparison of writing of two groups of students over three years beginning in third grade, one group making regular daily use of the word processor and the other little or none, it was concluded that using a word processor increased the quality of student work (Owsten and Wideman, 1997). In a meta analysis in which 28 studies obtained holistic measures of the quality of student writing, almost two-thirds of these found a positive connection between the quality of student's writing and access to word processing during writing instruction. Further, ten studies showed a statistically significant improved quality result related to word processing while only one study found a statistically negative result (Bangert-Drowns, 1993). Additionally, the impact of word processing on the quality of writing appears to be increasing. In a later meta analysis of studies from 1992-2002, Goldberg, Russell, and Cook (2003) found an increased positive

impact on the quality of writing that is word processed compared to the quality impact found in earlier research. They further stated that the overall impact of word processing on the quality and quantity of writing was more significant for middle and high school students than for elementary students.

Along with many studies indicating a favorable connection to writing using a computer, one study indicated keyboarding skill could be taught at the same time as language arts skills without an adverse effect. Sormunen and Wickersham (1991) found fourth grade students who were learning to keyboard could also learn language arts skills as well as students who only used traditional paper, pencil, and/or oral methods. Sormunen and Wickersham (1991) indicated the findings of their study encourage development of an interdisciplinary approach when building keyboarding skill.

<u>When to Teach Keyboarding</u>

A review of the literature reveals differences as to when and to what degree keyboarding should be taught. Much research points to students developing a familiarity with the keys instead of learning a touch skill prior to third grade. The International Society for Technology in Education (ISTE) stated in their National Educational Technology Standards For Students that prior to the completion of second grade students should be able to use a keyboard to successfully operate a computer (ISTE, 2000). In a 12-year longitudinal study of 263 Wisconsin school districts representing 62% of the districts in the state, Rogers (2006) discovered that keyboarding instruction was on the rise in elementary schools (85% in 2005 versus 54% in 1993) beginning with an early awareness in kindergarten through second grade. Of the Wisconsin school districts including elementary keyboarding in the curriculum in 2005, the touch method was

introduced in four (1.8%) school districts at the kindergarten level, in thirteen (5.9%) at the first-grade level, and in sixteen (7.3%) at the second-grade level (Rogers, 2006).

Kahn and Freyd (1990) were convinced from their understanding of whole language methodology and their experiences working with young children at computers that keyboarding instruction at the elementary level that focuses on touch-typing skills was inappropriate. In their interviews with second graders who had at least three separate writing occasions, enough familiarity was obtained by the students to prefer use of the keyboard over pencil and paper. Those with less time at the computer still reported pencil and paper preference due to a lack of keyboard familiarity. Based on their repeated observations of kindergarten and first grade children, it was concluded that these children did not need a touch-typing skill (Kahn and Freyd, 1990).

According to the National Business Education Association's *Keyboarding Strategies Guide*, touch keyboarding instruction should occur just prior to students needing the skill for composition or sentence writing. Instead of setting an absolute age or grade level, the *Keyboarding Strategies Guide* indicates the more important issue is coordinating instruction so it takes place before students begin frequent and consistent computer usage (NBEA, 2006).

ISTE indicates that prior to the completion of 5th grade students will use keyboards efficiently and effectively (ISTE, 2000). Kahn and Freyd (1990) indicated that whole language teachers interpret "efficiency" as related to the purpose of use of the computer. They observed students developing their own "hunt-and-peck" systems that matched and exceeded handwriting efficiency. Children only need to key as fast as they can write with pencil and paper (Kahn and Freyd, 1990).

While the debate continues as to when and what degree to introduce keyboarding skills, Rogers (2006) found that of the elementary schools introducing keyboarding instruction in 2005, 42% introduced touch keyboarding at the third-grade level and 36% did so at the fourth-grade level. This compares with 15.7% in third grade in 1993 (Rogers, 2006).

In a study of 88 Massachusetts students ranging in age from 7.8-13.4 year olds Pisha (1993) discovered that older students tended to improve their keyboarding skill faster than younger students. The researcher did not recommend delaying keyboarding instruction based on this finding. Also, occasional use of the computer for homework seems to develop keyboarding skills more rapidly. Further, students as young as eight or nine can learn keyboarding and regular in-school practice can affect the rate at which this occurs. (Pisha, 1993).

In another study of elementary-age students given instruction during 24 twenty-minute sessions, children eight and nine years old improved their keying speed and accuracy over the course of instruction. The improvement for seven-year olds however, was called, "very modest" (UCLA/UES, 1997).

Amount of Keyboarding Instruction Needed

A total of 50 students split evenly between fifth and sixth grade were given 40 minutes of keyboarding instruction a day for five weeks. The researcher concluded this was insufficient to secure the skill (Wronkovich, 1988). When a higher level touch skill is not the desired approach students can still achieve keyboarding speeds that approximates handwriting speeds with no formal typing instruction for speed or accuracy. In another study of sixth grade students, the mean keying speed of 34 sixth graders rose from 6.62

words per minute to 10.12 words per minute in about six months with approximately one hour a week of composing and revising time in pairs at a computer and no formal instruction (Kahn and Freyd, 1990).

In Rogers' (2006) longitudinal study of over 250 Wisconsin school districts, very little uniformity was found among schools in regard to time spent teaching touch keyboarding. In 1993, the most common instructional time indicated was 25-45 minutes every day for six weeks. In 2005 it was once a week for 36 weeks for 30-40 minutes (Rogers, 2006). It should be noted that the 2005 figure represented only 19 school districts underscoring how diverse current keyboarding instruction is.

Continued Usage After Training

How well a student does in achieving speed is based on opportunity to input information after initial training. Sormunen examined a two-year study completed as part of the Indiana State Department of Education's Buddy Project. With initial instruction of daily sessions of 30 minutes for four weeks, 44 fourth grade students used their new keyboarding skill at least one-half hour daily for the remainder of the year. Their mean speed score after this first year was 24.47 words per minute. At the end of the second year in which at least 30 minutes per day were devoted to inputting word, phrases, or sentences, student mean speed score increased to 33.50 words per minute (Sormunen, 1989).

When a sample of third through sixth grade students was studied, those students who used a computer at least occasionally for homework developed keyboarding skill at a greater rate than those who never used a computer for homework. (Pisha, 1993). At University Elementary School in California, the seven- to nine-year olds who showed the

greatest gains in a study of children's keyboarding skills, were those who used the computer most often at home and who spent more time engaged in word processing activities (UCLA/UES, 1997).

In a 32-session elementary keyboarding pilot program of two fourth-grade classes, all children had made measurable gains in keyboarding skills after the eight-week session. Six weeks later another posttest administered after the keyboarding class had finished showed that most of the gains were not maintained. Although elementary students could learn to key well, continuous practice was needed to maintain their skill (Warwood, 1985).

A recommendation from a study of elementary school students stated the development of keyboarding skills needed to continue into the established curriculum. It was further stated that without continued use, developed skills would regress to initial keyboarding rates calling to question this expenditure of time, money, and energy in the first place (MacIntyre, 1990).

Moving From Visual to Feel

An often cited keyboarding researcher is Leonard West. His early studies continue to carry weight in the keyboarding field. In one early study, West examined the relationship between level of skill and extent of utilization of kinesthetic cues. West found that there was a sharp rise from low levels of kinesthetic feedback among novices as they approached speeds in the low to mid 20s (West, 1967). The importance here is that as student's rates improved to the low to mid 20s, they were increasingly able to identify that a reach error was made by how the reach felt. The National Business Education Association *Keyboarding Strategies Guide* refers to moving from visual to feel

as the "cognitive phase". They stated in the beginning stages of keyboarding, learners

will tend to mouth or vocalize the letters. This is known as a "mediator" and impedes

skill development. The removal of the mediator occurs as students key approximately 18-

23 wpm (NBEA, 2006).

Benjamin Bloom studied the process of talent development in outstanding

individuals. In using high typewriting skill as an illustration of the automaticity that is

displayed in mastery of a skill, Bloom (1986) commented that how fast you (an automatic

keyboardist) get your ideas on paper is controlled more by the speed of your thoughts

than your typing skill. He concluded his illustration by stating that conscious attention to

what the fingers are doing impedes the automatic typing process (Bloom, 1986).

Other Important Factors

A look at what is said about a few other factors will help round out the research

on keyboarding. One of those factors relates to how sex of a person effects attaining a

keyboarding skill. In a study of elementary students the sex of the subject does not seem

to be related to the development of keyboarding skills (Pisha, 1993).

In terms of who is teaching elementary keyboarding, Rogers' (2006) study of

Wisconsin school districts reported an increase in the number of elementary classroom

teachers that were teaching keyboarding. In 1993, business education teachers were

primarily responsible for teaching keyboarding (70% of respondents), but in 2005

business teachers fell to 27% (Rogers, 2006).

In a study of voice-recognition software, three researchers stated they believe it is

likely, in the future, that much of our writing will be done using voice-recognition

software rather than by typing at a keyboard. However, the subject studied found that

writing with a voice-recognition system was very different from writing with a keyboard and learning how to use the voice-recognition system required a great deal of effort (Hartly, Sotto, and Pennebaker, 2003).

Summary

    Although the training of keyboarding is done at different grade levels and to differing degrees depending on where a student goes to school, there is little question to the importance of keyboarding. The review of the literature indicated word processing improved the quality of students' writing.

    In spite of the importance of keyboarding, research revealed diversity as to when it should be taught and for how long. The research suggests students are able to quickly become familiar with the keyboard to use it for word processing. Additionally, research revealed students can move beyond familiarity to develop touch skills and higher speeds with training. Further, research indicated continued use after training will lead to an increase in skill level. With this higher skill students reach a point where little thought is needed to operate the keyboard. Training students to key at this level requires a significant investment of time. It is with this in mind that this study will examine the relationship of initial touch speed achievement of fifth graders on their touch keyboarding skill retention in seventh grade.

CHAPTER 3: PROCEDURES

<u>Research Design</u>

The purpose of this study was to examine the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade. This action research study used a correlational and longitudinal design to generate primarily quantitative data. Scores on two timing attempts for seventh grade students in the researcher's Computer Applications classes were recorded with the best score used to correlate with a best score on timing material of similar difficulty in fifth grade. The Measurement Writing section of Lesson I in the MicroType keyboarding software program (Appendix C) was used to reveal keying speed and errors. Students were allowed one warm-up timing on the test material. All students were required to use a cover (Appendix D) that fits over the keyboard to block the view of the keys. Scores were recorded on a researcher-prepared spreadsheet. Students with greater than five errors on the first timing were encouraged to key accurately and to correct more errors as they keyed the second attempt. Timings in fifth grade were recorded with a five or fewer error requirement as well. Beta testing of the timing showed nearly all students are able to record a timing of five or fewer errors in two attempts. The highest speed attained with five or fewer errors was paired with the speed score data from fifth grade and used for statistical analysis. Additionally, data on possible additional factors effecting keyboarding skill was collected using a researcher-designed survey (see Appendix B).

Sample

The subjects for this study were 132 seventh grade students in the researcher's Computer Applications classes at a large suburban middle school in southeastern Wisconsin. The researcher taught and collected data from these students in fifth grade. Any students not in the original fifth grade classes were allowed to take timings with other students but their data was not included in the results. Students are predominately Caucasian. Special Education students are part of the regular classroom and were included in this sample.

Instruments

The data was collected from three sources. First, data sheets from fifth grade keyboarding classes during the 2004-2005 school years provided speed scores. The scores were recorded in words per minute categories of 10, 13, 15, 17, 20, 22, 25, 27, 30, and 32 with five words per minute categories starting at 35. Second, speed scores from Lesson I timings in MicroType were recorded for students in seventh grade Computer Applications. The timing (Appendix A) is rated as easy in difficulty by the program. A keyboard cover (Appendix B) was used on all timings. Third, students completed a researcher-designed survey (see Appendix C) to provide information on factors, other than initial speed in fifth grade, which may affect speed in seventh grade.

Data Analysis

Several inferential statistics were used to test the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade. Two t-tests at the .05 level of significance were completed on the relationship between initial touch speed in fifth grade and seventh grade touch speed.

The first t-test was for speeds below 20, while the second t-test was for speeds of 20 and above. Three tables were used to split speed scores into categories of different ranges. Within each range a t-test was calculated to determine if a significant relationship at a .05 level of significance exists between initial touch speed in fifth grade and touch speed in seventh grade. A variety of ranges were used to examine more thoroughly speed changes from fifth to seventh grade. Line charts were also developed to show each student's fifth grade score with their seventh grade score to see if any pattern exists. Additionally, mean gains were calculated to assist in identifying any patterns.

For data collected on the survey, t-tests were completed for categories of access to a home computer and hours of computer usage to determine if a significant relationship at the .05 level of significance exists between initial and ending speeds in these categories of data. Finally a Pearson-r was calculated for the relationship of attitude toward touch keyboarding and seventh grade touch speed.

Calendar

December 2006-January 2007   Developed survey and organized for data collection

February, 2007   Beta tested survey and data collection

April, 2007   Administered timings and distributed surveys

April-May, 2007   Analyzed data and reported findings in chapters 4-5.

May, 2007   Revised and completed final draft of research paper.

May, 2007   Received final approval of research paper.

July, 2007   Attended Pro-seminar and commencement.

Budget

The cost to conduct this study was minimal.

CHAPTER 4: RESULTS

<u>Introduction</u>

The purpose of this study was to examine the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade. This was a correlational and longitudinal study generating quantitative data.

Touch timing scores were collected from fifth grade students in nine-week keyboarding classes during the 2004-2005 school year. The fifth grade students were able to take as many timings as they wanted while working in skill building lessons of the MicroType keyboarding software program. In order to have a timing recorded, students were required to use a cover (Appendix B), use the measurement writing portion of the program which provided up to two minutes of material, and have five or fewer errors. The students received no formal instruction after the initial nine-week course in fifth grade. Approximately two years later in January and April of 2007, the researcher was able to record touch timing scores from 132 of these students as they participated in a keyboarding review unit in seventh grade. Additionally, the seventh grade students were given a short survey (Appendix C) to determine if other factors effected speed level two years later.

To determine if there is a relationship with initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade, the researcher will answer the following questions:

1. What level of touch speed allowed students to retain and improve their skill?

2. To what extent is initial touch speed achievement related to seventh grade skill level?

3. What other factors effected touch speed level two years later?

Discussion of Results

Null Hypothesis: There is not a relationship between initial touch speed achievement of fifth grade keyboarding students and touch keyboarding skill retention in seventh grade. The answer to the null hypothesis was built by testing at various speed ranges to see if each range has a level of significance. If before a certain speed range a t-test indicates no significant difference in speeds, but after a certain speed range a t-test does indicate a significant difference in speeds, the tests will reveal a relationship based on changes in significance. Two t-tests at the .05 level of significance were completed. For scores below 20 words per minute, Table 4.1 shows a t-stat of 1.852 and a critical value of 2.011 at 48 degrees of freedom. Therefore, there is no relationship below 20 words per minute. For scores 20 words per minute and above, Table 4.2 shows a t-stat of 7.076 and critical value of 1.971 at 212 degrees of freedom. This indicates there is a relationship above 20 words per minute. Therefore, there is a relationship between initial touch speed of fifth grade keyboarding students and touch keyboarding skill retention in seventh grade based on a change of significance at approximately 20 words per minute and the null hypothesis is rejected.

Table 4.1
Relationship of Initial Fifth Grade Speed Below 20 wpm and Seventh Grade Speed

t-stat	df	Critical Value
1.852	48	2.011

Table 4.2
Relationship of Initial Fifth Grade Speed 20 wpm or Above
and Seventh Grade Speed

t-stat	df	Critical Value
7.076	212	1.971

Research Sub Question 1:   What level of touch speed allowed students to retain and improve their skill?

Students in seventh grade were allowed one practice timing on the measurement writing (Appendix A) for Lesson I of the MicroType program. Student's hands were blocked from view with a cover (Appendix B). Students were asked to have five or fewer errors. Backspacing to correct errors was permitted. Students then completed a second timing and the researcher recorded it in a spreadsheet. A third timing was taken and the score was again recorded in a spreadsheet. In nearly all cases a timing score with five or fewer errors was obtained in the two recorded tries. About five percent of the students required more than two attempts in order to achieve a score with five or fewer errors. The best speed score with five or fewer errors was used to compare with the best score from fifth grade.

The researcher used 3 tables to split the speed scores into categories of different ranges. This was done to examine more thoroughly the relationship at the .05 level of significance between initial touch speed in fifth grade and touch speed in seventh grade. These tables guided the researcher to the ranges used in Table 4.1 and Table 4.2 to test the null hypothesis. Table 4.3 uses 5 ranges, Table 4.4 uses 8 ranges, and Table 4.5 uses 12 ranges. Within each range a t-test assuming equal variances at the .05 level of significance was calculated to determine if the change between initial and ending speeds in the range was statistically significant. A positive t-test would indicate the difference between initial and ending scores was significant while a negative t-test would indicate the difference in scores was not significant.

Each table shows the calculated value of the statistic, the degrees of freedom, and the critical value of the statistic for different ranges. Equal variances at the .05 level of significance are assumed for the t-tests.

Table 4.3
T-tests for 5 Speed Ranges

Range	t-stat	df	Critical Value	Significant Difference
10-16	1.125	24	2.064	No
17-24	3.418	46	2.013	Yes
25-31	5.074	58	2.002	Yes
32-39	5.689	42	2.018	Yes
40 and above	5.527	84	1.989	Yes

Table 4.4
T-tests for 8 Speed Ranges

Range	t-stat	df	Critical Value	Significant Difference
10-14	1.473	10	2.228	No
15-19	1.578	36	2.028	No
20-24	4.791	22	2.074	Yes
25-29	5.322	40	2.021	Yes
30-34	3.613	38	2.024	Yes
35-39	4.498	20	2.086	Yes
40-44	4.000	30	2.042	Yes
45 and above	5.500	52	2.007	Yes

Table 4.5
T-tests for 12 Speed Ranges

Range	t-stat	df	Critical Value	Significant Difference
10-12	.0977	6	2.447	No
13-14	1.142	2	4.303	No
15-16	0.489	12	2.179	No
17-19	1.538	22	2.074	No
20-21	4.520	12	2.179	Yes
22-24	2.329	8	2.306	Yes
25-26	4.267	26	2.056	Yes
27-29	3.422	12	2.179	Yes
30-31	1.700	16	2.120	No
32-34	3.655	20	2.086	Yes
35-39	4.498	20	2.086	Yes
40 and above	5.527	84	1.989	Yes

Explanation of Table 4.3: The comparison of scores in the 10-16 range yielded a

t-statistic of 1.125. When compared to the critical value of 2.064 for this range, no

significant difference is found in scores. The next set of scores in the 17-24 range yielded

a t-statistic of 3.418. When compared to the critical value of 2.013 for this range, a

significant difference was found in the scores. In all ranges 17-24 and above, the table

indicates a significant difference was found in the scores.

Explanation of Table 4.4: This table consisted of slightly smaller ranges than

Table 4.3. The t-statistic was below the critical value for both the 10-14 and 15-19 ranges

indicating no significant difference was found in the scores. For range 20-24 and all

those above it, the t-statistic was above the critical value in all cases indicating a significant difference was found in the scores.

Explanation of Table 4.5: Table 4.5 consisted of smaller ranges (see chapter 5 for limitations on initial scores) than tables 4.3 and 4.4. For all ranges below 20, the t-statistic was below the critical value indicating no significant difference was found in the scores below the 20 level. For the ranges of 20 and above, all ranges except the 30-31 range had a t-statistic above the critical value for the range indicating significant difference was found in the scores.

Summary of Sub Question 1

According to tables 4.3, 4.4, and 4.5, the speed ranges in which student scores began to show a significant difference were 17-24, 20-24, and 20-21 words a minute. Below these ranges the tables indicate no significant difference in speed scores. When student's initial fifth grade touch speed scores were in the range of 20 or more there was a significant difference in the touch speed scores in seventh grade.

Research Sub Question 2:   To what extent is initial touch speed achievement related to seventh grade skill level?

Chart 4.1 shows the speed scores below 20 words a minute. The chart shows a nearly even split between scores that rose since fifth grade and scores that decreased since fifth grade. Charts 4.2, 4.3, and 4.4 show comparisons of speeds 20 and above and indicate a majority of scores rose since fifth grade for students reaching speeds in the higher speed ranges. Additionally, Chart 4.4 indicates that only 2 students who achieved 40 words a minute or better did not improve on their speed score 2 years later.

Chart 4.1

Comparison of Speeds Below 20

Chart 4.2

Comparision of Speeds 20-29

Chart 4.3

Comparison of Speeds 30-39

Chart 4.4

Comparison of Speeds 40 and Above
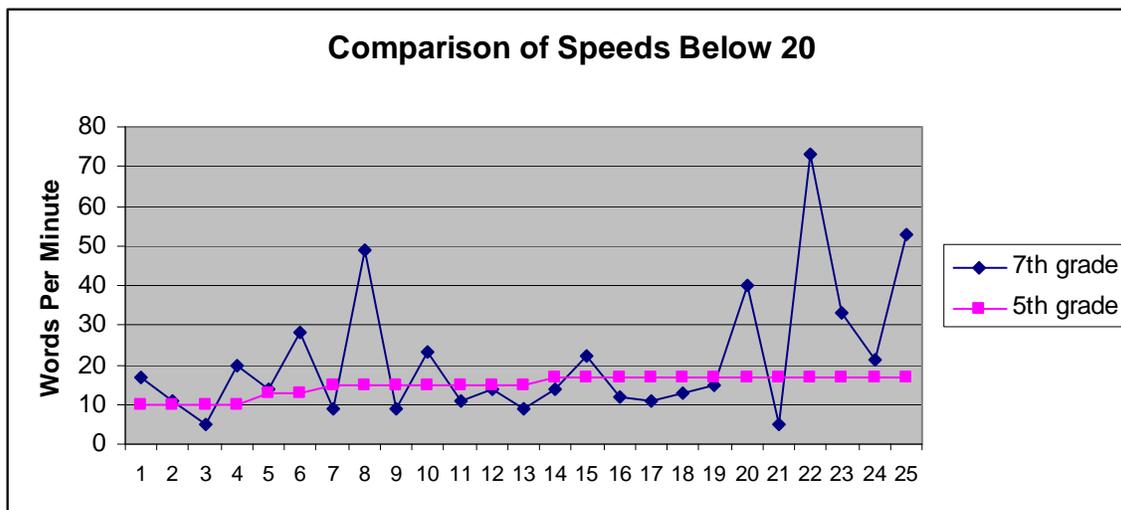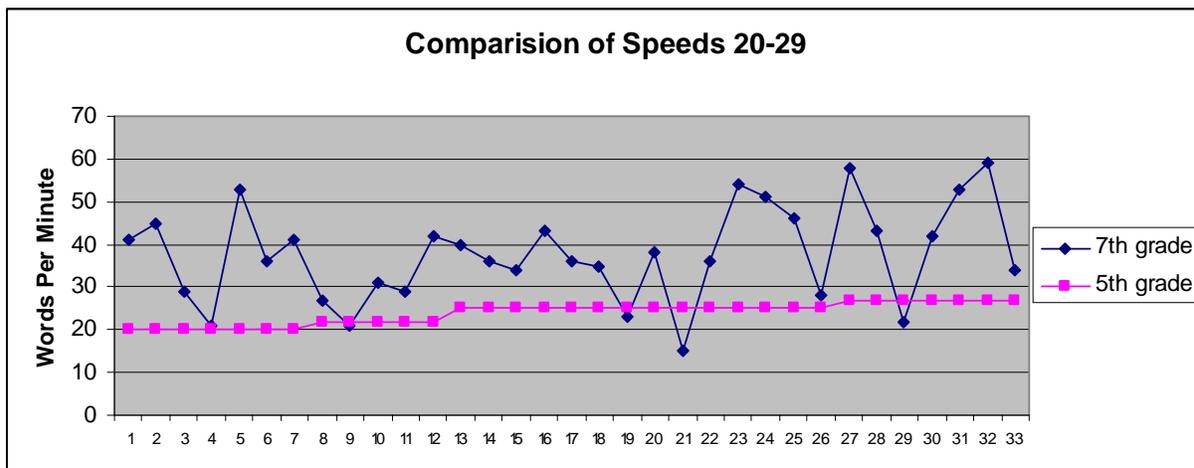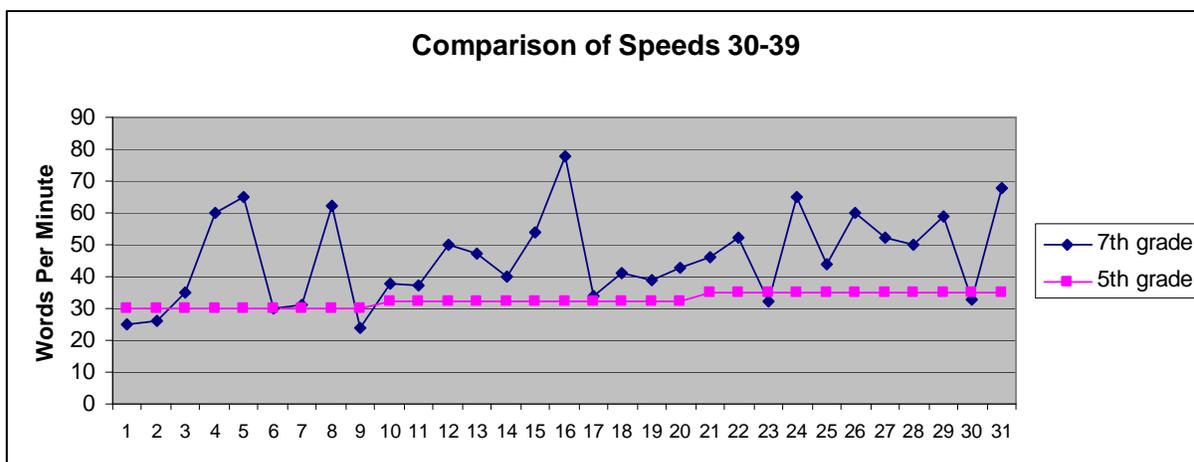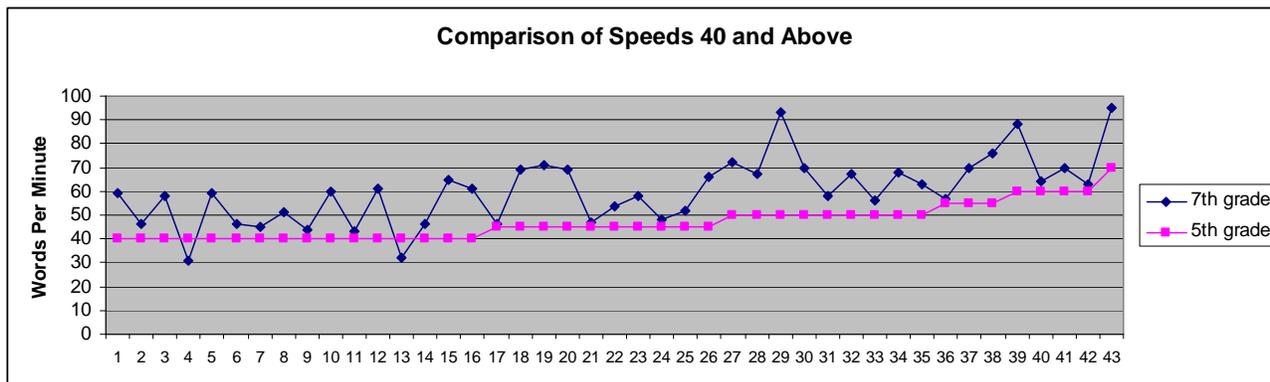
Table 4.6 indicates speed gain averages for 4 speed ranges. For ranges 20-29, 30-39, and 40 and above the means were 13.73, 13.32, and 13.23 respectively. For the 10-19 range the mean gain was 6.24 words per minute. The median gain was 1 word per minute for the 10-19 range. The 10-19 range had the smallest mean and median average gains when compared to the higher ranges.

Table 4.6
Average Speed Gains in Words Per Minute

Range	Mean Gain	Median Gain
10-19	6.24	1
20-29	13.73	13
30-39	13.32	11
40 and Above	13.23	13

A t-test at the .05 level of significance was performed on the score gains or losses since fifth grade for initial speeds of less than 20 words a minute compared with initial speeds of 20 or more words a minute. The test with 130 degrees of freedom indicated a t-statistic of 2.595 and a critical value of 1.978. This indicates there was a statistically significant difference in the gains of students with initial keying scores of 20 or more when compared to the gains of students with initial scores less than 20.

Research Sub Question 3: What other factors effected touch speed level two years later?

A researcher developed survey was completed by 128 seventh grade students. The survey was developed to determine if any additional factors influenced speed between fifth and seventh grade. Questions were created for access to a home computer, hours of computer usage a week, and attitude toward keyboarding.

<u>Home Computer Access Since Fifth Grade and Speed Difference</u>

Of the 128 students surveyed, only 6 did not have complete computer access since fifth grade. The speed difference of students with complete computer access and those with less than complete access was compared. A t-test at the .05 level of significance and 129 degrees of freedom indicated a t-stat of 1.639 and a critical value of 1.979. No significant relationship could be found between home computer access and speed achievement.

A closer look at students without home computer access shows 3 of the 6 students who did not have home computer access when learning to key lost speed (see Chart 4.5). These 3 students were below 20 for initial fifth grade speed as well.

To further explore the relationship of home computer access to speed difference a t-test at the .05 level of significance between students at 20 or less who had no computer access and those at 20 or less that did have access was calculated. A t-stat value of 1.202 was found and compared to a critical value of 2.074. No significant difference was found.

Chart 4.5
Speed Scores for Students with No Home Computer Access When Learning to Key
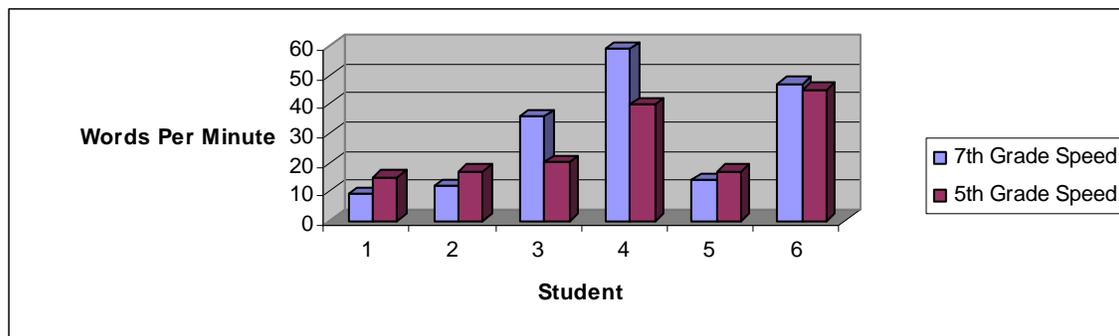
Hours of Computer Usage and Speed Difference

The researcher created 5 ranges of hours and did a t-test at the .05 level of

significance for each range to see if a significant relationship exists between speed scores

from fifth to seventh grade for the range of hours tested. Table 4.7 shows no significant

relationship between speed scores from fifth to seventh grade for computer users of 2 or

less hours. All ranges above 2 hours showed a significant relationship exists between

speed scores from fifth to seventh grade.

Table 4.7
Relationship of Fifth to Seventh Grade Speed Scores for Various Levels of
Computer Usage

	0-2	**2.1-5**	**5.1-10**	**10.1-15**	**15.1 and Above**
t-statistic	1.316	2.954	2.840	2.845	4.476
df	64	62	48	32	40
Critical Value	1.998	1.999	2.011	2.037	2.021

There were 24 students completing the survey question who scored less than 20

words a minute in fifth grade. Chart 4.6 shows that when these students used the

computer 2 or less hours a week, 8 of 11 students lost speed two years later.

Chart 4.6
Relationship of Weekly Use of 2 or Less Hours and Speed Change for Students with
Fifth Grade Scores Less Than 20
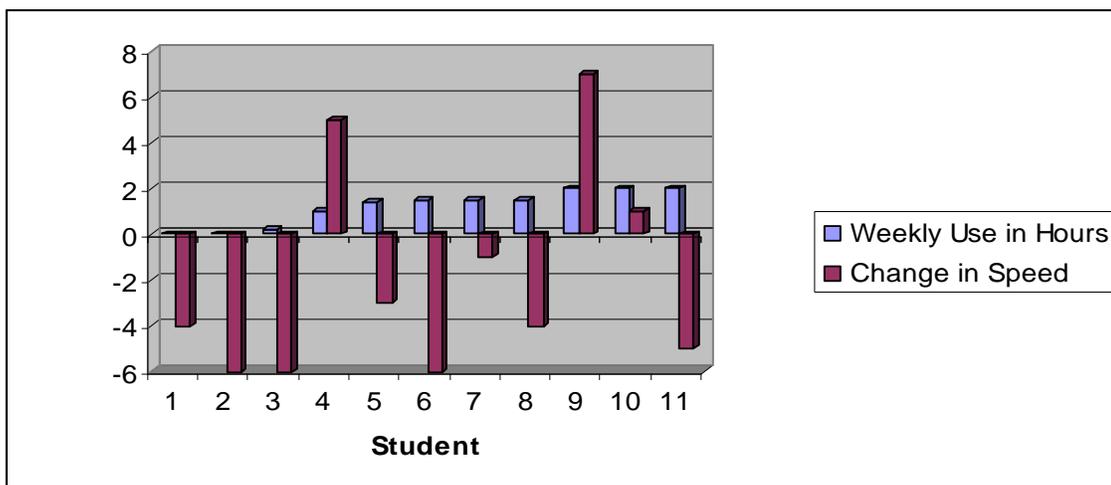
For the same group of 24 students with initial speed scores of 20 or less, but used the computer for more than 2 hours a week, Chart 4.7 shows 9 of 13 scores increased.

Chart 4.7
Relationship of Weekly Use of More Than 2 Hours and Speed Change for Students with Fifth Grade Scores Less Than 20
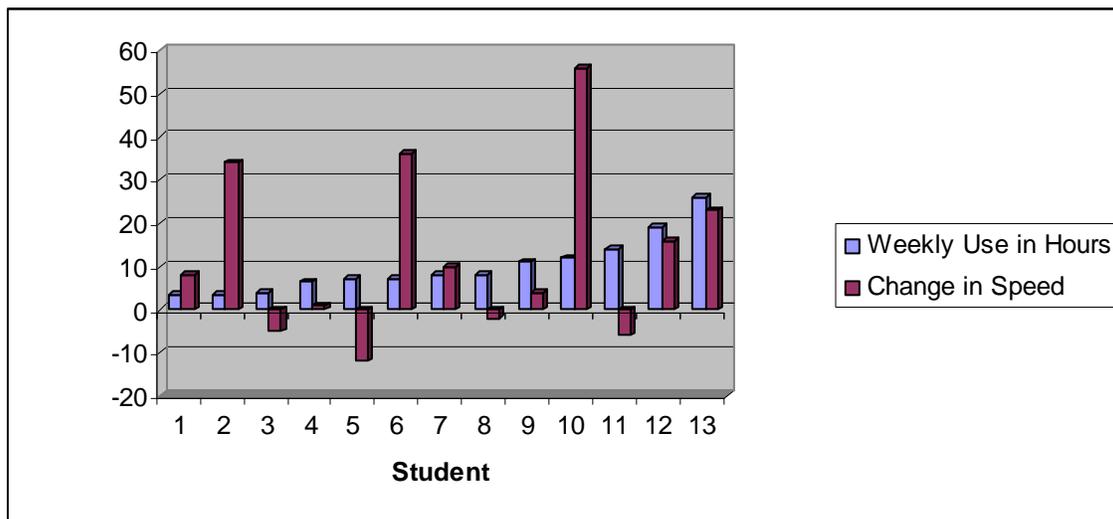
To examine initial fifth grade speed scores of less than 20 and their ending seventh grade speeds for certain hours of usage, a t-test at the .05 level of significance was performed resulting in Table 4.8. Students initially keying less than 20 and spending less than 2 hours a week on the computer showed no significant relationship in their scores from fifth to seventh grade. However, students initially keying less than 20 and spending more than 2 hours a week on the computer did show a significant relationship between their scores from fifth to seventh grade.

Table 4.8
Impact of Weekly Hours of Usage on Relationship of Initial Fifth Grade Speed Scores of Less Than 20 and Ending Seventh Grade Speeds

	2 or Less Hours	2.1 or More Hours
t-statistic	1.528	2.136
df	20	24
Critical Value	2.086	2.064

Using the same hour ranges as in Table 4.7, the researcher created Table 4.9 and Chart 4.8 with means. The mean jumped from a 4.36 words per minute increase for weekly usage of 2 hours or less to increases of 12 words per minute and more for higher hourly ranges. As the length of time students stated they spent on the computer increased, so did the mean gain in speed increase.

Table 4.9
Mean Gain in Speed Fifth to Seventh Grade Based on Weekly Hours of Usage

Hours of Weekly Usage	Mean Speed Gain (wpm)
0-2	4.36
2.1-5	12.16
5.1-10	14.04
10.1-15	15.06
15.1 and Above	18.62

Chart 4.8
Words Per Minute Speed Gain and Weekly Hours of Usage
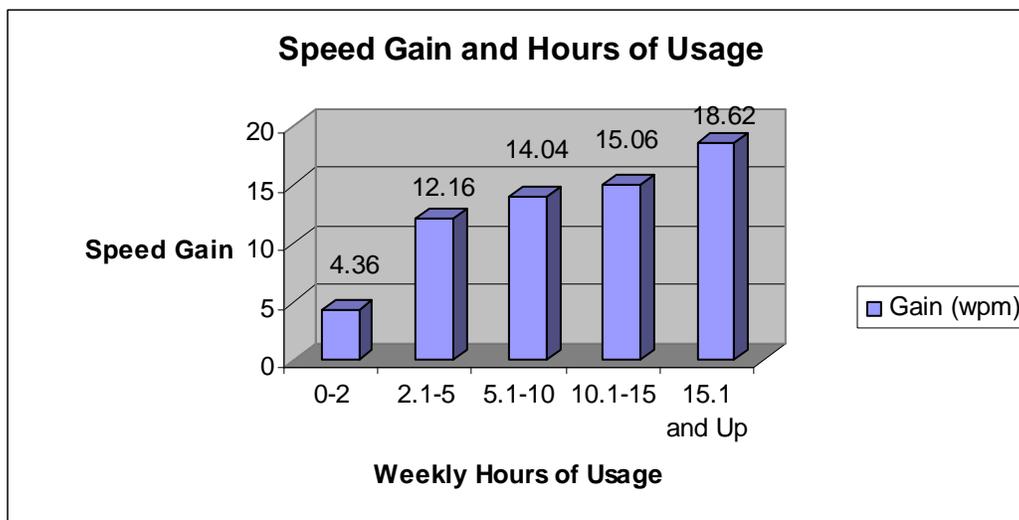
<u>Attitude and Change in Speed</u>

This survey question asked: "How important do you feel being able to key by touch is for you?" Students responded by circling a number from 1 to 5 with 1 meaning little, 3 somewhat, and 5 very. Table 4.10 shows the results of this testing. A Pearson r test comparing the seventh grade score with attitude did reveal a statistically significant relationship between speed and attitude.

Table 4.10
Relationship of Attitude to Seventh Grade Speeds

Pearson-r	0.468
df	254
Critical Value	<.195

<u>Summary</u>

There is a relationship between initial touch speed of fifth grade keyboarding students and touch keyboarding skill retention in seventh grade based on a change of significance at approximately 20 words per minute. Two sub questions were explored in this chapter to develop the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade. An additional sub question examined other factors effecting speed achievement in seventh grade.

Sub question 1 was posed to determine what level of touch speed allowed students to retain and gain in their skill. The researcher examined 3 sets of ranges and found student scores began to show a significant difference with the ranges of 17-24,

20-24, and 20-21 words a minute. Below these ranges the tables indicate no significant difference in speed scores from fifth to seventh grade.

Sub question 2 examined the extent of initial fifth grade touch speed achievement on seventh grade skill. The researcher used a series of charts that revealed fifth grade students with scores of 20 or above had a majority of scores rise in seventh grade. A t-test indicated the gains of students with initial touch keying scores of 20 or more were statistically different when compared to the gains of students with initial touch scores less than 20.

Next, t-statistics were calculated for such factors as having a computer at home since fifth grade and for hours of usage per week. No significant relationship was found related to having access to a computer since fifth grade. For computer usage in an average week there was no significant relationship between speed scores from fifth to seventh grade for computer users of 2 or less hours. However, all ranges above 2 hours showed a significant relationship exists between speed scores from fifth to seventh grade and hours of usage.

Lastly, a Pearson-r tested for a relationship between attitude toward touch keying skill and final seventh grade touch touch speed achievement. The test did reveal a significant relationship between seventh grade touch speed achieved and attitude toward touch keying skill.

Overall the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade changes around the 20 word a minute speed level. This finding answers the purpose of this study and chapter 5 discusses its implications and conclusion based on the results.

CHAPTER 5: CONCLUSIONS

Introduction

The purpose of this study was to examine the relationship of initial touch speed achievement of fifth grade keyboarding students on their touch keyboarding skill retention in seventh grade. This was a correlational and longitudinal study generating quantitative data.

Chapter 5 is arranged in the following manner:

- Study background-a brief discussion of keyboarding at the researcher's middle school to give the reader additional background on this study.

- Discussion of the findings- This includes conclusions of this researcher based on results of the study and where possible comparison with conclusions of other researchers in chapter 2. The null hypothesis and research sub questions will be used to guide this discussion.

- Limitations of this study and possible effects on the results are discussed.

- Summary and future implications-This includes a summary of the major findings and conclusions of this study. Also, the researcher shares how results of the study have affected his teaching.

Study Background

I have had the opportunity to teach over 2000 students the skill of touch keyboarding. Continually I find myself fine tuning my lessons to see if different approaches will help students to learn better. We are fortunate at our school to be able to offer 9 weeks of daily instruction in touch keyboarding to fifth grade students. Then in seventh grade as part of my Computer Applications course, I complete a keyboarding

review unit of about 1 week. What typically happens is that most students I had in fifth grade have retained and improved upon their touch skill by the time I see them again in seventh grade. Some though have not gained much or have lost much of their touch skill and need to relearn the reaches. Generally, most students coming in from other schools and not learning to key in the fifth grade have poor technique and limited skill. Of the 127 students in the recent review unit, 17 students took part in the relearning unit and 110 worked in review and skill building. Of the 110 students skill building, 36 were able to key better than 60 words per minute with their hands covered and 2 students keyed over 100 words per minute. It is my desire to see fewer students who trained under me in fifth grade needing to relearn in seventh grade. Thus, the conclusions in this study will provide immediate relevance to this teacher's approach to keyboard training. Perhaps the conclusions will also provide others with means to improve their work.

<u>Discussion of the Findings</u>

Null Hypothesis: There is not a relationship between initial touch speed achievement of fifth grade keyboarding students and touch keyboarding skill retention in seventh grade. Two t-tests were conducted on the relationship between initial touch speed in fifth grade and seventh grade touch speed. The first t-test found no relationship for speeds below 20. The second t-test found a significant relationship with speeds starting at 20 wpm and above. Because of this the null hypothesis was rejected. There is a significant relationship between initial touch speed in fifth grade and what student touch speeds are in seventh grade. Additional support for this finding is developed through answering the sub questions to this study.

The first sub question was, "What level of touch speed allowed students to retain their skill? This researcher concludes that approximately 20 words per minute were needed for students to retain their touch skill. The t-tests for various speed ranges (see tables 4.3-4.5) indicate a clear change in significance at the 20 words per minute level. This is supported by the descriptive data of Chart 4.1 that shows 12 of 25 speeds actually decreased from fifth grade when students did not achieve 20 words per minute or better. Charts 4.2-4.4 show nearly all seventh grade students retaining and gaining in skill if their fifth grade touch speed reached or exceeded 20 words per minute. In chapter 2 the researcher cited 2 studies that made statements related to a level where less cognitive effort is needed as skill rises; however, the actually studies these statements were based on were not shown for this researcher to view. West (1967) did say that there was a sharp rise from low levels of kinesthetic feedback among novices as they approached speeds in the low to mid 20's. Basically this means that as speeds exceeded 20 words per minute, learners of the keyboard were better able to determine an incorrect reach was being made by its feel. The National Business Education Association *Keyboarding Strategies Guide* refers to moving from visual to feel as the "cognitive phase". At the beginning stages of keyboarding, learners will tend to mouth or vocalize the letters. This "mediator" impedes skill development. According to the *Keyboarding Strategies Guide* the removal of this mediator occurs at approximately 18-23 wpm (NBEA, 2006). Personally, in my keying skill I do not have to think about the letters as I key. My fingers automatically reach for the keys with little cognitive effort. My study shows about 20 words per minute to be a "pivot" point for retention. If students do not move through this range to automaticity

they will continue to use some type of "mediator" which impedes their skill. As Chart 4.1 shows, this results in some students not retaining their skill level.

Not all students keying less than 20 words per minute failed to retain or build on their skill, but a pattern emerged that helped separate those who gained from those who did not. A further analysis of the fifth grade scores in the less than 20 ranges found those students who spent more than 2 hours a week using the computer since fifth grade showed speed increases in 9 of 13 students. On the other hand, nearly all speed changes were negative for students with initial speed scores of 20 or less and computer usage time of 2 or less hours a week. Even if students scored 20 or less initially, they could retain and improve their speed scores from fifth grade by using the computer for 2 hours or more a week. When students did not achieve 20 words a minute initially and spent little time at the computer their initial skill was likely to regress. The conclusion here is to encourage continued use of their keyboarding skill, especially if initial touch speed scores were less than 20 words per minute.

The second sub question was, "To what extent is initial touch speed achievement related to seventh grade skill level?" The conclusion here appears fairly straightforward. When students achieved initial fifth grade scores of 20 words per minute or better by touch, the likelihood they would retain or gain in skill was high. On the other hand, if initially fifth grade touch scores were less than 20, there was only about a 50% chance of maintaining skill. Further, Table 4.6 shows that the average gain for scores less than 20 was 6.24 words per minute, while gains for those above 20 were over 13 words per minute. In fact, the median gain for those less than 20 was only 1 word per minute. It was interesting to note that having initial speeds in the ranges of 20-29, 30-39 and 40 and

above did not produce an increasingly higher average increase. The increase in each of these ranges was nearly identical at about 13 words per minute.

The third sub question was, "What other factors effected touch speed level two years later?" This was answered through a 3-question survey. The first question asked students to indicate whether or not they had access to a computer at home since learning to key in fifth grade. Over 95% of students did have access and as expected, the t-stat showed no significant relationship in effect on speeds could be found between those who had home computer access and those who did not. There were simply too few who did not have continual access to a computer to make any worthwhile determinations.

The second survey question asked students for their average usage per week on keying activities such as report typing, e-mailing, and Instant Messaging. Although I believe the averages students gave were very rough, students using the computer for more than 2 hours a week on average showed a statistically significant relationship with speed scores. It would appear that using their skill would continue to anchor it. Also, a pattern emerged with the mean gain. When students spent 2 or less hours a week on the computer the mean speed gain was 4.36 words per minute. When students spent over 15 hours a week using the computer for keying activities the mean gain was 18.62 words per minute. The mean gain consistently increased as students indicated more time spent on the computer. The conclusion here is the more time doing keying activities after initial training the more gain a student can expect. One researcher cited in chapter 2 came to a similar conclusion when examining continued usage after training. Sormunen (1989) found an increase in skill the second year after learning to key for students devoting at least 30 minutes per day inputting words, phrases, or sentences.

The final survey question was asked to determine if attitude played a role in the speed achieved in 7th grade. A Pearson r test showed a significant relationship between their speed and their attitude. This seems to be a reasonable result. However it may be the case of which came first? I can see where a good speed would have a student feeling positive about keyboarding, but also believe a good attitude about keyboarding could help in doing what it takes to be successful.

Limitations of Study

This longitudinal study required data from 2 years prior. Students in fifth grade were able to attempt as many timings as they wanted as long as they met the qualifications of hands covered, doing measurement writing, and having 5 or less errors. The students could choose from a range of lessons with timings rated as very easy, easy, and low average. The timings scored in seventh grade were from the same lesson and rated as easy with a limited number of attempts allowed. The fifth grade students being able to take as many attempts as they wanted on material rated as very easy may have resulted in higher scores than if the researcher had been able to take exit timings using the same material as used for the timings in seventh grade. Also, scores in fifth grade were recorded in ranges of 10, 13, 15, 17, 20, 22, etc. The researcher used the low end of the range as an absolute score to calculate statistics. This was based on the assumption that students were allowed as many attempts as possible to get to that range. Another possible limitation was with the second question of the survey which asked students to come up with an estimate of time usage per week of a computer for keyboarding. Even though students were told to consider they may have used the computer less in fifth grade, the averages given must be looked upon as very rough estimates. However, the students

citing 2 or less hours per week may have a more accurate estimate given the lower time

needed to calculate their estimate.

<u>Summary and Future Implications</u>

       The conclusion that can be drawn from this study is students keying 20 or more

words per minute by touch were more likely to retain their skill 2 years later than students

who initially keyed less than 20 words per minute by touch. Students who keyed less than

20 words and stated they had 2 or less hours of computer usage a week were highly

unlikely to retain their keyboarding skill 2 years later. However, students keying less than

20 words per minute, but making use of their skill more than 2 hours a week would most

likely improve on their skill.

       An implication of the findings is the importance of developing initial touch skill

level above 20 words a minute. If the question were posed as to how long a training

program should be this researcher would answer, "One that allows students to acquire a

touch skill level of 20 words a minute or better." Students in this study were able to

develop their skill during a nine-week course that met every day. Out of 132 students in

this study, 107 students were able to develop an initial touch skill at 20 or above in fifth

grade. It is important to have a keyboarding program that permits enough consistent time

to develop the touch skill. For those students not acquiring a 20 word per minute or better

touch skill level during the initial training, additional time could be provided to help them

attain this level. Further, as students are training and I identify them at risk for not

achieving 20 words per minute or better by touch, I could encourage additional time. I

find that my fifth grade students are highly motivated to learn. In fact, I now have a

number of students come in during their lunch recess to get additional practice during the

time they are learning their skill. The findings of this study I believe support the approach

our school is taking to train our students to key by touch. I also believe I will see more

gains in the future as more students make commonplace use of e-mail, chat, and Instant

Messaging thereby using their keying skill several hours a week.

It would be interesting to research the touch keying ability of students who train

under a differing format. Rogers (2006) found very little uniformity among schools in

regard to time spent teaching touch keyboarding. In 2005, the most common instructional

time indicated in Rogers' study was once a week for 36 weeks for 30-40 minutes. This

researcher has doubts as to whether a mastery of touch keyboarding can be obtained by

most students using this approach. Given that keying skill is more than a classroom tool,

but an important personal productivity tool as well, I believe it would be shortsighted to

train merely for familiarity and have many students never gain higher speeds. With scores

collected after my recent seventh grade review unit, nearly 25% of all my seventh grade

students can key 60 words a minute or better with their hands covered. I would like

research done related to developing the higher speed ranges in students. In particular, this

researcher would be interested in the effects of using a keyboard cover during certain

aspects of training versus those trained without a cover on overall speed achievement.

This researcher is working to remedy potential shortcomings in future studies as

well. I am now taking exit timings from fifth grade students and will use the same timing

2 years later to more accurately compare skill changes.

A thank you note from a fifth grade student states well the importance of training

students correctly: "Dear Mr. Ertl, Thank you for teaching me how to tipe. I am already

using it to do a report. And it is going a lot faster on the computer. At my old school they

tried to teach us to tipe, but we only had it once a week so we didn't really learn how to type. But we got to go every day in your class so we learned how to tipe. Thanks." Although she didn't correctly spell the word "type" each time in her letter, she made the point very well. On top of learning to key, there is a good chance she was above 20 words a minute and on her way to a useful lifetime skill of keyboarding.

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APPENDIX A
MEASUREMENT WRITING LESSON I

Lesson I — Time Remaining 2:00 — Game Chances 0

Error Allowance: 12 uncorrected errors

Accuracy	Errors	Rate (gwam)

Key the paragraphs. Correct your errors as you key. You will be timed for 2 minutes.

    Most people in learning to key grow quickly for a time
after they learn all the letters. Then for many, it seems,
growth stops and they hang in at about the same speed for a
few days or longer. This period of no growth puzzles them.

Keyboard Mastery | Improve Technique | Sentences | Paragraphs | Measurement Writing | Game | Lesson Report

Lesson I — Time Remaining 1:11 — Game Chances 0

Error Allowance: 12 uncorrected errors

Accuracy	Errors	Rate (gwam)

Key the paragraphs. Correct your errors as you key. You will be timed for 2 minutes.

    If growth seems to stop for a while, do not give up or
quit. Such a period of no or little growth happens in most
skills. Expect this to occur to you along the way and work
just a little harder on good form to get growth going again.

Keyboard Mastery | Improve Technique | Sentences | Paragraphs | Measurement Writing | Game | Lesson Report

APPENDIX B
KEYBOARD COVER

Photos taken from: http://www.keyboardteacher.net/index.html

The Touch-Key Guide
(student's view)

Fig.2
(corner view)

Fig.3
(side view)

APPENDIX C
SURVEY

Keyboarding Survey   Name_____

The questions you are answering will be used in research related to keyboarding.

1. How long have you had access to a computer at home? (**check only one**)

_____ I have had access since learning to key in fifth grade

_____ I did not have access right after learning to key, but did later on in fifth grade

_____ I began to have access in sixth grade

_____ I began to have access in seventh grade

_____ I have not had access to a computer at home

2. With this next question, keep in mind that you may do more of this activity now than you did in fifth grade. Since fifth grade keyboarding, how much time each **week on average** have you spent:

a) Gaming and Internet surfing at home _____

b) Doing keying activities such as: report typing, e-mail, chat, and Instant Messaging **at school** _____

c) Doing keying activities such as: report typing, e-mail, chat, and Instant Messaging **at home** _____

3. How important do you feel being able to key by touch is for you?

   1   2   3   4   5
 Little   Somewhat   Very