WHERE, WHEN, AND HOW TO TEACH KEYBOARDING

by

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Where, When, and How to Teach Keyboarding.

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ABSTRACT

Many schools are faced with having microcomputers in the classroom and finding an efficient way to use them. Before the microcomputer can be effectively used, the human user must be able to communicate with the computer without too much frustration. The standard interface with the computer is the keyboard. The keyboard must be used with some degree of efficiency to make adequate use of the many features a microcomputer can offer children and adults. There is much debate as to the best time to introduce formal keyboarding instruction to children so that they can better utilize the microcomputer. This thesis examined this question.

The research was carried out in a lower mainland, Fraser Valley school district which had a focus on the development of keyboarding skills. This provided a valuable opportunity to research the question when it might be best to introduce formal instruction in keyboarding skills.

Students from grade one to ten were examined using a pretest and posttest on speed and accuracy. The sample size ranged from 20 students in grade ten to 100 students in grade eight. The pretest was conducted

before any formal keyboarding instruction. The posttest was administered after twelve hours of instruction.

After the instruction period, students were tested and the results of both the pretest and posttest were subjected to two tailed t-tests to see if the results were statistically significant. A summary and explanation of the results are presented. The author concludes that it is possible for all levels of students to keyboard, but that some grade levels are able to acquire the necessary skills much more readily.

The author suggests that a keyboarding instruction program in the schools could profitably begin at the grade five level. It is in the range from grade five to eight that the greatest increase in the proficient use of keyboarding skills could be developed. If there is an 'ideal' grade at which to introduce children to the use of the keyboard, it would be grade six.

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CHAPTER 1

INTRODUCTION AND STATEMENT OF THE PROBLEM

It has been predicted that there will be a computer with a keyboard in at least 80 percent of North American homes by 1990. The schools, it is therefore argued, need to teach keyboarding as soon as practical so that students can utilize the skill as a communication tool throughout their educational experience and professional lives. (Hedley, 1985)

It is imperative that schools provide instruction on how to effectively use these computers, whether it be for home use, educational use, or job related use. The question is when is the "best" time to introduce instruction, how long it should be taught and where it should be introduced.

Many school districts have implemented a keyboarding instruction program from Kindergarten up to grade seven. In most cases the appropriate level at which to make the introduction is based on the opinion of experts and not firmly based on research. There does not appear to be a great deal of recent research to support the introduction of formal keyboarding instruction at any one particular level, so the experts base their opinions on what they believe can happen.

Most students from kindergarten to senior grades can learn to keyboard, although it is somewhat more difficult for students who do not know their alphabet nor do they know how to read. Children may run into a number of difficulties as they learn to keyboard. For the younger children the size of the keyboard may present some difficulties. Some students may experience difficulty is assimulating information. When keyboarding, students can utilize the skill to use a computer as a tool so they are able to transfer the written word or character from a page or screen into a keystroke on the computer. Younger children are slower at this transition only because they are not as familiar with reading as the older students. If these problems create difficulties in teaching students to keyboard, then it is important to find out if they influence the keyboarding instruction already being implemented in the elementary classroom.

A number of questions arise from this discussion. How long should the keyboarding instruction be in order for students to learn enough keyboarding skills to have some degree of proficiency? Should instruction be limited to the secondary level or should it be taught at the elementary level as well?

At what grade level should keyboarding instruction begin? Is there a best grade level for keyboarding instruction?

This study was designed to give some direction in answering the question of where, when, and how to teach keyboarding. A number of elementary schools in the Fraser Valley had sufficient computers to teach children to keyboard, and the teachers in these schools were willing to pilot a keyboarding project for the purposes of this study. The study was designed to have students perform a speed and accuracy test at the beginning of the study, and to also perform a posttest using the same material at the end of the study. From the data collected the scores on each of the tests were compared in order to determine for each grade level the degree of proficiency students were able to reach. The tests also provided information as to the grade level that was best suited for introducing a keyboarding instruction program. The length of the program also served as an indicator of how long the instruction period should be. With the exception of two individuals, the teachers involved in the study were not trained for teaching keyboarding. The two who were fully qualified taught the grade eight, nine, and ten students.

As a Business Education teacher the debate whether keyboarding could be profitably taught in the elementary school was a concern. With this concern in the forefront ,the purpose of the study was

1. to determine "when" to begin keyboarding instruction, the "best" grade level to begin formal instruction so that students would develop a degree of proficiency at the keyboard
2. to determine "how" long a keyboarding instruction program should be in order to be effective and have an element of skill and knowledge that would continue to be developed
3. to provide some guidelines for teachers when implementing a keyboarding program within the schools

The review of the literature in Chapter Two discusses the research that has been conducted using keyboard instruction as its basis. As the amount of research in this area is limited, the discussion also includes background information on keyboarding instruction. The teachers involved in this study did not want any possibility of being identified, therefore demographic data has not been included as part of this study.

Chapter Three provides a description of the keyboarding program used in the study. Also included in this Chapter is the description of the research methodology.

Chapter Four provides an analysis of the data collected from the pretest and posttest scores. The data is examined using means, standard deviation, variances and t-tests for each grade level.

A summary of the study is provided in Chapter Five. The chapter includes finding, recommendations, limitations and suggestions for further research.

DEFINITION OF TERMS

The following definitions are terms which are used throughout this study.

1. Elementary School:

   a school offering studies in a variety of subjects from Kindergarten to Grade Seven.

2. Secondary School:

   a school offering studies in a variety of subject from Grade Eight to Grade Twelve

3. Keyboarding:

   The action of using a keyboard to type information into a computer.

4. Speed:

   The rate at which a person enters characters from the keyboard into the computer. Speed is calculated in words per minute. A word is considered to be 5 strokes, the strokes consist of any character or special key. This study uses gross words per minute in which no penalties are taken from the score for errors. The definitions are the standrad ones used by typing teachers.

5. Accuracy (errors):

The number of errors committed during a timed test when keyboarding. An error is committed if the material being copied is not an exact duplicate. Standard error rules are followed in this study. There is only one error counted per literal word, punctuation errors are counted as part of the preceeding word, an indentation error is counted as part of the word following. These are standard definitions drawn from business education programs.

6. Level of Proficiency

Based on a review of the literature and programs available for typing courses, a speed of 10 words a minute is considered to be a minimum level of proficiency.

CHAPTER 2

REVIEW OF THE LITERATURE

INTRODUCTION

There are many articles written about keyboarding, when is the best time to introduce keyboarding, why keyboarding should be introduced and how keyboarding should be implemented. Many of these articles are based on opinions of the writer and not on actual research.

It is not unusual to find comments about the value of keyboarding in many different journals and publications. For example (Hoot 1986) states "the primary device for enabling students to interact with computers is currently the keyboard." Luehrmann (1984) suggests that keyboarding should be a prerequisite before a student enters a computer class because time at the computer is wasted if it is spent hunting for keys on the keyboard. Jenkins (1987) also observes that is is becoming increasingly important . . . for people of all ages to acquire basic keyboarding skills. It is important for students to use computers more efficiently through the use of keyboarding instruction, Wetzel (1985) states "students who can't type have a hard time using the word processor".

A review of the literature provides little evidence of research involving the "best" time to introduce keyboarding to students, although many schools are introducing keyboarding at the elementary level. According to a survey done by John Stoecker (1987) teachers in the United States felt the third and fourth grade levels were the ideal time to teach keyboarding.

Hoot (1986) indicates that it is only through research that we can determine if keyboarding instruction with younger children is indeed a must ... or a mistake. Surveys give us opinions of what is considered the "best" situation, whereas research is a better indicator of the real possibilities. Balajthy (1988) tells us that "the purpose of keyboarding instruction at the elementary level is to familiarize students with keyboard layout and provide at least a minimal level of proficiency in touch typing". This is important so that students do not pick up hunt and peck habits at an early stage before keyboarding is introduced .

KEYBOARDING RESEARCH

Keyboarding instruction has become an important issue with the introduction of computers to the elementary classrooms. At times there are not

enough computers to adequately teach keyboarding skills and to determine whether students can learn to touch type at an early age. Dacus and Dacus (1983) reviewed several options for keyboarding instruction in the elementary school. The keyboarding course was offered as a continuing education program at New Mexico State University. The main objective of this course was to help students with the acquisition of language and reading skills. The grade levels involved in the study were from grade four to grade eight. The course lasted six weeks with classes meeting two nights a week for two hours. The two-hour class length was determined to be too long and subsequent classes were taught for one hour four days per week.

Frankeberger (1985) also offered keyboarding instruction to fourth and fifth grade students on a volunteer basis. There were sixteen students who volunteered to take the course. The students attended one-half hour classes for eight weeks in order to learn keyboarding skills. The emphasis in this course was to teach touch typing. The students learned their keyboarding skills on a typewriter and as a reward were permitted to use the micro-computers.

An experimental class for a summer enrichment program was developed by Kaake (1983) to teach students

keyboarding skills. This program enrolled 26 students in two classes, which met one hour per day, four days per week for eleven weeks. Electric typewriters were used for the keyboarding instruction. All of the keys were introduced by the fourteenth day of instruction and after the fifth week the students were composing their own materials.

Hedley (1985) taught 24 children aged five to eight years the touch method of keyboarding. The classes met for nineteen days for twenty minutes per day. Six of the five and six year old girls reached the predetermined goals and were somewhat stressed, while the six five and six year old boys did not reach the predetermined goals and were quite frustrated. The remaining twelve children exceeded the predetermined goals and exhibited a high degree of self-motivation. Based on this limited experience, it was concluded that children progressed more readily with touch keyboarding after they had learned the alphabet, numbers, and learned to read, a result that is hardly surprising!

Students keyboard at different levels, these levels generally increase with the age of the student. Wetzel (1985) concluded that students who can type ten gross words per minute can make adequate use of the computer for tasks requiring significant amounts of

keyboard entry. For grades Kindergarten to grade three, twenty words a minute with accuracy could be considered adequate for software use, while grades four to six, twenty-five words with accuracy for input of complete sentences would be efficient (Kisner, 1984).

Kaser's (1984) research reported that the kindergarten to grade two classes typed eight to fifteen words per minute; grade three students typed fifteen to twenty-five words per minute; and grade four to grade six students typed twenty to forty words per minute accurately in a six-week time frame. (Cowles, Hedley, and Robinson, 1983), in a study determined that five to eight year old children, after nineteen days of instruction were able to keyboard at a rate of ten gross words per minute.

SUMMARY

In all of the studies reviewed, children from kindergarten to high school were able to keyboard. The minimum words per minute a student was able to type was ten words per minute. This level of proficiency, according to the literature, was fast enough to use the computer effectively. Most of the studies indicated that students in the intermediate level were able to keyboard at a quicker pace than the primary grades. It was evident that students from the grade three level and higher were used in most of the studies conducted, little evidence was found to support introduction at the kindergarten, grade one and two levels.

CHAPTER 3

METHOD

INTRODUCTION

This study use a pre-posttest design in order to examine the hypothesis that students from Grade 1 to Grade 10 could be taught the mechanics of keyboarding. This chapter begins with a description of the research sample and a brief description of the variables used in the study. The chapter closes with a description of the methods used in analyzing the data.

RESEARCH SAMPLE

Data was collected from children in eight different schools in a Fraser Valley School District. The school locations were chosen on a volunteer basis, as were the classroom teachers. Teachers were asked if they would be willing to participate in the study and only those volunteering were used. The background of each of the teachers involved was not a determing factor in their

selection to be part of the project. Indeed, demographic data on each of the teachers was collected after the experimental period before the data analysis was completed.

A total of four hundred and forty-seven students were given both the pretest and the posttest. These tests gave a measure of speed and accuracy. (see Appendix XX for the pretest and posttest results). No quota was set as to the number of classes that could participate in the study.

The sample was separated by grade and age level if more than one grade was instructed as a class unit. By segregating students in this manner, the pretest and posttest results could be analyzed as to the grade level of the students involved.

Keyboarding was being introduced as a part of the elementary curriculum in a number of schools in the district, and hence students saw this study as a normal part of their classroom activities. Each student in this study was given the pretest and the results were recorded without the use of names. The students could not be identified in any manner.

The test results were sent to the researcher without the name of the school or the name of the teacher attached in order to preserve the anonymity of the students and teachers involved. The results were identified by grade level only.

No attempt was made to control or direct how teachers taught the keyboarding unit. Therefore, it may be the case that the test results were affected by the teaching experience and expertise of the instructors. However, no data was available to confirm or deny this conjecture.

The background of each teacher was recorded after the results were submitted. All of the teachers involved were volunteers and each of the teachers was enthusiastic about teaching children the manual skill of keyboarding. Two of the teachers had a background in Business Education and had experience in teaching keyboarding to students. Most of the other teachers involved were teaching keyboarding for the first time, although one of the teachers in the primary area had previously taught keyboarding.

GROUP DESCRIPTION

The groups of students were broken down as follows:

Grade	Number of Students	Number of Classes
1	37	2
2	43	2
3	22	1
4	39	2
5	76	3
6	28	1
7	60	2
8	100	4
9	22	1
10	20	1

TEACHER PREPARATION

As noted earlier, all but two of the teachers involved did not have any experience in teaching keyboarding to students. Several of the teachers attended workshops on tips and techniques of teaching keyboarding. The workshops were provided by the Computer Studies Helping Teacher for the school district. The workshop provided the teachers involved with methods of introducing homerow and subsequent keys to the students. If any of the teachers had difficulty with the keyboarding instruction, they had access to the Helping Teacher at all times. An outline of the workshops is provided in Appendix III.

Each of the classes for a particular school were instructed by the same teacher. Hence, it may assumed that the method of instructing within each school was consistent since the instructor was the same. However, the instruction varied from school to school because of the differences in the background of the teachers involved. All teachers placed an emphasis on good typing techniques and habits.

TREATMENT TIME AND MODE

At the start of the treatment period, the teachers administered the pretest. They then embarked

on the keyboarding unit which covered all grades, which was designed to be twelve class hours of instruction. The amount of instruction time remained consistent but the number of weeks from the beginning to the end of the study was not consistent. Some schools completed the pretest and posttest in four weeks, while others took three months. The posttest was administered after the twelve hours of instruction was completed.

The amount of practice between instructional sessions was not controlled. Some students had access to computers at home and could practice their keyboarding skills, but the majority of the students only had access to the computers provided at the school. Practice time was provided in some classrooms using cardboard keyboards as an alternative to typing on the computer equipment. The classes used the cardboard keyboard until it was their turn to use the computer.

SOFTWARE AND HARDWARE

The curriculum materials used for the keyboarding instruction was consistent across the schools. The textbook used was entitled MASTERING THE KEYBOARD (Dulmage 1984). This book was chosen because the author was a noted expert in the area of

keyboarding who has given numerous workshops throughout North America. A textbook was chosen over a typing tutor program because tutors tended to encourage hunt and peck techniques. Although students could work at their own pace with the tutor, it was more difficult to introduce new keys as a group. Keys were not always introduced in the same order from one program to the next and the cost of the tutors over the textbook could not be justified.

Other materials which were used varied from school to school, and in particular a variety of word processing programs were used. One school used FREDWRITER. Another school used BANK STREET WRITER. The grade eight to grade ten program was taught using APPLEWORKS. Other schools used TYPING TUTOR or MAGIC SLATE. All of the schools taught the keyboarding unit on Apple or Apple compatible equipment. The type of software selected depended upon its availability to the school. Most of the schools had already purchased word processing software. Since students were not learning the use of the word processing software but were only to learn how to keyboard, software selection was left up to the discretion of the teacher.

The situation for equipment was not ideal. The secondary classrooms had instructional labs where

every student had access to a computer. In the elementary schools, students had to take turns on the computer. Those students not using the computer were instructed using cardboard keyboards. The equipment was mainly Apple IIe computers and some Apple II GS computers.

PRETEST/POSTTEST

The pretest used was developed by Kathleen Dulmage. It was included as part of her curriculum materials, and gives a measure of student skill when keyboarding. The test consists of simple three to five letter words. The words do not form a sentence structure in the first lines. The words themselves are real words found in the English dictionary. They are not nonsense words so the student has difficulty reading the material. The last two lines of the test are complete sentences.

The same test was used as the posttest so that a valid comparison of the data could be made. (A copy of the pretest/posttest is provided in Appendix I.)

The pretest was given students before the keyboarding instruction began. All of the students were instructed when to begin typing and then were timed for a duration of one minute. At the end of the

one minute time period, students were instructed to stop typing. The number of strokes they typed were recorded as well as the number of errors they had made. This test was repeated two more times so that a total of three scores were recorded for the pretest. The

scores were then averaged. The final results of the pretest were then recorded using the average from the three scores.

After the twelve hours of instruction were completed, the students then took a posttest using the same test. Once again the students were instructed when to start typing and then timed for one minute. The scores were recorded for both speed and accuracy. This test was also repeated two more times. The scores were averaged and the results using the average score for both speed and accuracy were recorded.

The results of the pretest and posttest were placed on sheets of paper where only scores for speed and accuracy were shown. The names of the students were not recorded nor was the name of the teacher. Only the grade level was indicated at the top of the sheet. The test results were then submitted to the researcher via school mail so that the name of the school was unknown.

The pretest and posttest were both scored as to the number of strokes completed within the time limit set out by the instructor. The actual speed in words per minute was determined by the researcher. The number of strokes was divided by the average number of

strokes per word (the average number of strokes per word used by the Curriculum Guide for Business Education is five strokes per word). The result is the net words per minute typed. These calculations were completed by the researcher after the results of the pretest and posttest were submitted.

The pretest and posttest used did not have any norm references. Any comparison to other groups using this test was not possible. Only those groups within this particular study can be compared using this particular pretest/posttest.

METHOD OF ANALYSIS

Raw data was transferred into categories for speed and accuracy by grade level. This was done so that the data collected could be analyzed using Powerstat, a program developed by Analytical Engineering Corporation. Appendix XX details the coding system utilized for the use of this program.

Powerstat allows the researcher to transform the data into frequencies to determine whether or not any of the areas analyzed show a marked trend. As well, statistics such as the mean and standard deviation can be determined through the use of

Powerstat to provide the basis for analyzing if there were any statistically significant differences between the various study attributes. Finally, the Powerstat program allows the researcher to focus on a group with particular traits, such as age or grade level, to determine whether or not they indicate a difference between the speed and accuracy from the total group.

SUMMARY

Chapter Three presented the research design and data collection methods utilized in the study, and indicated which of the variables in the study that could be controlled.

CHAPTER 4

ANALYSIS

INTRODUCTION

In this chapter the results of the statistical analysis of the data are presented. The chapter begins with an overview of the statistical results of the entire population and the conclusions reached from those results. Next is a further overview of statistical analysis on results segmented by grade level, according to the two variables, speed and accuracy. The chapter then closes with a summary of the information obtained from the statistical analysis and graphic representations of the data.

GRADE LEVEL POPULATION RESULTS

In order to test the study hypothesis that there would be a difference in the speed and accuracy of students when comparing various grade levels, a pretest and posttest for both speed and accuracy was given to all subjects. The tests had two components, one for speed, measured in net words per minute, and the other for accuracy, measured in the number of errors per minute. The speed and the accuracy measurements were scored according to the Ministry of Education guidelines for scoring timed tests for typewriting.

TABLE I summarizes the results obtained for the speed and accuracy (errors), Pretest and Posttest, and includes further information on the breakdown for each component for every grade level tested. Speed and Errors indicate the results were from the Pretest while Pspeed and Perrors indicate the scores were from the Posttest. In order to determine whether or not a statistically significant difference exists between speed and pspeed as well, as for the errors and perrors, a t-test was conducted yielding the p-value for the means between pretest and posttest scores. The results of the t-tests are in TABLE I under the p-value column. For each comparison of pretest and posttest results, the p-value was considered significant at the 0.01 level. The N value is significantly large for each of the grade levels to allow for use of this statistic.

The null hypothesis for each grade level comparison was 'the mean of the result for either speed or errors was equal to the mean of the result for pspeed or perrors'.

The alternative hypothesis for each grade level comparison was 'the mean of the speed or error

pretest was not equal to the mean of the pspeed or perror posttest at the p-value of 0.01 level of significance.

With reference to TABLE I, which provides the results of the grade level pretest and posttest results, it is shown that in the grade ten level that there was not a significant difference in keyboarding speed between the pretest and the posttest scores but there was a significant difference in keyboarding accuracy (errors) between the pretest and the posttest. The null hypothesis therefore was not rejected. The null hypothesis was rejected for the errors/perrors comparison at the 0.01 level of significance. There is a significant difference between the means for errors and perrors at the grade ten level.

The null hypothesis for speed and pspeed comparisons on the pretest and posttest was rejected at the grade nine, grade eight, grade seven, grade six, grade five, grade four, grade three, and grade one levels at the 0.01 level of significance. At the grade two level the null hypothesis was not rejected at the 0.01 level of significance for speed and pspeed comparisons. That is to say, it can be seen at the grade two and ten levels, there was not a statistical change in the speed at which students typed.

The null hypothesis for errors and perrors comparisons on the pretest and posttest was not rejected at the grade nine, grade eight, grade seven, grade five, and grade three levels at the 0.01 level of significance. At the grade ten, six, four, two, and grade one levels the null hypothesis was rejected at the 0.01 level of significance.

A close look at TABLE I shows the grade ten students did not increase in speed but the number of errors dropped from a mean of 1.7 to a mean of 0.25. The increase in accuracy is a possible reason why the mean in keyboarding speed did not show a significant increase. The students had possibly reached a plateau in keyboarding speed while accuracy was increased with the extra practice over the twelve hour period. The mean speed score for keyboarding speed and pspeed was the highest for all the grade levels tested. This shows an indication that speed improves with the age level of the student. The grade nine speeds, on the other hand, show that the mean decreased in value but the number of errors remained the same. The concentration on accuracy rather than speed could explain the difference in the speed scores. Accuracy appears to play an important part in the teaching of keyboarding in the higher grade levels.

The grade eight group increased their speed far more significantly than those students in grade ten and there was not a significant change in the number of errors. Although their speed did not reach the mean level of the grade ten group, it did surpass that of the grade nine's. The mean number of errors was unchanged at the grade eight level as well as at the grade nine level, though the reduction of the number of errors was not signifcantly different. The size of N (100) for the grade eight level is much higher than the size of N (22) for the grade nine level, which could affect the results on the pretest and posttest scores, though the t-test is quite robust.

Grade seven also showed an increase in keyboarding speed, but the mean number of errors increased slightly. The difference between the means for errors was not significant but the increase in the keyboarding speed was significant. Students appear to be able to increase the speed in keyboarding without changing the mean number of errors. The accuracy at this level did not show any improvement and it also did not increase even though the speed increased. Students at the grade seven level learned keyboarding and improved their speed without affecting the number of errors. This indicates that these students were able to learn keyboarding effectively.

TABLE I

GRADE	TEST	N	MEAN	STANDARD DEVIATION	P VALUE	SIGNIFICANT NON-SIG
10	Speed	20	24.2500	9.1816		
	Pspeed		24.6500	8.7556	0.3590	NS
	Errors		1.7000	2.2266		
	Perrors		0.2500	0.4443	0.0074	S
9	Speed	22	20.3182	7.0737		
	Pspeed		18.1818	5.9252	0.0006	S
	Errors		1.2727	2.0043		
	Perrors		0.5000	1.0118	0.1659	NS
8	Speed	100	17.6500	7.7790		
	Pspeed		21.0200	8.3218	0.0000	S
	Errors		2.2300	3.1135		
	Perrors		1.6400	2.4101	0.930	NS
7	Speed	60	15.4500	6.1187		
	Pspeed		19.3500	7.2971	0.0000	S
	Errors		1.3167	2.3252		
	Perrors		1.5333	2.2957	0.6095	NS
6	Speed	28	9.4643	2.9625		
	Pspeed	27	19.2222	5.0561	0.0000	S
	Errors	28	4.7143	5.1916		
	Perrors	27	0.4815	0.8932	0.0001	S
5	Speed	76	10.5789	4.1320		
	Pspeed		15.3289	6.3085	0.0000	S
	Errors		0.9737	1.7586		
	Perrors		1.4474	1.4085	0.0685	NS
4	Speed	39	6.2308	2.5388		
	Pspeed	38	8.3947	2.9366	0.0009	S
	Errors	39	0.4615	0.6003		
	Perrors	38	1.2632	1.1783	0.0003	S
3	Speed	22	6.0909	1.9001		
	Pspeed	20	8.5500	2.2821	0.0005	S
	Errors	22	0.7273	0.7673		
	Perrors	20	1.2000	1.0563	0.1027	NS
2	Speed	43	4.9070	2.2553		
	Pspeed	41	4.6585	1.6219	0.5654	NS
	Errors	43	0.4651	0.5916		
	Perrors	41	1.7561	1.5777	0.0000	S
1	Speed	37	2.9189	1.1874		
	Pspeed		4.0270	1.6070	0.0012	S
	Errors		0.5405	0.6053		
	Perrors		1.4324	1.8640	0.0072	S

The greatest increase in speed is at the grade six level. This group showed the greatest increase in the number of words per minute and the greatest decrease in the mean number of errors. This grade level appears to be the ideal place to teach keyboarding as the greatest changes between the pretest and posttest scores occur at this level. Students were able to learn keyboarding, improve their speed significantly and also improve the rate of errors at a significant level. This situation is the ideal situation for teaching keyboarding skills. Students improved their mean speed over 100% from the pretest to the posttest. None of the other grade levels increased their speed by this amount nor did any of the other groups decrease their mean number of errors by such a significant number.

The grade five group also increased the speed in keyboarding but the mean number of errors increased but not significantly. The grade five group was also able to learn the keys, increase the mean speed without changing the mean number of errors as is the case for the grade seven group. This group increased their speed by 45% while the grade seven group only increased their mean speed by 25%. The situation at the grade five level seems to be more ideally suited to begin keyboarding than the grade seven level.

The grade four group also showed an increase in the number of words per minute and an increase in the number of errors. Both of these differences proved to be significant at the 0.01 level for the p-value. Even though the speed in keyboarding increased and the level was significant, the number of words per minute did not clearly show that the grade four students could keyboard as efficiently as those students in the higher grade levels. Eight words per minute is not a very fast speed but the number of hours of instruction if increased may contribute to a greater increase in keyboarding speed and accuracy.

The grade three group also showed an increase in the speed and a increase in the number of errors. The change in speed is significant while the increase in the number of errors is not significant at the 0.01 level. The mean scores for the grade three group in speed are very close to the mean scores for the grade four group. The grade three group and the grade four group appear to fit together when looking at the mean scores but the grade threes did not increase their errors as much as the grade four group. Their mean number of errors on the pretest was higher for this group but the mean errors score on the posttest fell within the range of the grade one to grade four group.

speed signficantly but the increase in the number of errors was significant. The grade two level indicates that the speed stayed almost the same and with the introduction of more keys, the number of errors was increased. Other factors may have influenced this group such as the ability to reach all of the keys. The same appears to be true for the grade one level. Although the grade one speed increased at a significant level the mean number of errors also increased at a significant level.

TABLE I also shows a natural break between grade five and grade four for the increase in keyboarding speed. Grade five and up reached between 15 and 24 words per minutes while the grade one to grade four group achieved only 4 to 8 words per minute on the mean scores.

All of the groups fell within the 0 to 2 range for mean scores on accuracy. This seems to indicate that accuracy was stressed when the keyboarding instruction was given. The pretest scores showed a greater mean for errors as the range was from 0 to 5.

The keyboarding instruction and keyboarding practice helped to improve the accuracy of the students involved in the study.

Each grade level showed some type of change. TABLE IIa shows all the possible situations that could arise from the pretest and posttest comparisons. These possible situations are ranked according to their importance in learning to keyboard. The ideal situation would be to have the speed up a significant number and the numbers of errors decreasing, the worst possible situation is to have the speed decreasing and the errors increasing.

The actual situation according to the p-values are recorded in TABLE IIb. Each situation is then ranked according to the 'possible situation'. There appears to be three distinct groups within the chart. The first group consists of students at the grade nine and grade ten level. The second group consists of students at the grade five, grade six, grade seven, and grade eight level. The third group consists of students at the grade one, grade two, and grade four level. The grade three level does not appear to fit within these groupings and appears to be anomalous. If TABLE I is referenced at this point, the mean score for typing speed shows the grade two level does actually

TABLE IIa

CHANGES IN SPEED AND ACCURACY IN KEYBOARDING

RANKING OF POSSIBLE SITUATIONS		
Number	Situation	
	Speed	Errors
1	+	-
2	+	=
3	=	-
4	-	-
5	=	=
6	+	+
7	=	+
8	-	=
9	-	+

TABLE IIb

STUDY FINDINGS FOR CHANGES IN SPEED AND ACCURACY

GRADE	ACTUAL SITUATION		RANKING
	SPEED	ACCURACY	
10	=	-	3
9	-	=	8
8	+	=	2
7	+	=	2
6	+	-	1
5	+	=	2
4	+	+	6
3	+	=	2
2	=	+	7
1	+	+	6

fit within the grade one, two and four grouping. The number of errors also increased as did the errors within this group, the only difference was the change for the mean number of errors was not significant even though it did increase. The mean number of errors in the pretest was the highest, and the mean number of errors was the lowest within this grouping.

It would appear from the results that the grade tens may have reached a level where speed was difficult to increase and the accuracy was improved at the expense of the speed. A different situation occurred at the grade nine level, the speed went down and the accuracy remained unchanged. In grade five, grade six, grade seven, and grade eight, the speed improved and the errors either remained unchanged or decreased. It would appear that from the t-tests and situation ranking that the optimal setting for introducing keyboarding occurs at the grade five to grade eight, levels.

The lower grades, grade four, grade two, and grade one, the speed increased or remained the same and the errors increased. Even though there was a significant difference in the typing speeds for this group, there was also a significant difference in the number of errors. This may indicate that the students

were trying to increase their speed at the risk of producing more errors.

The last group, the grade three level, showed an increase in speed but also showed no significant change in the number of errors. This group does not appear to fit with the grade levels above and below. There is no logical explanation as to why this group should be different from the other groups in the number of errors. The group does fit, however, with the increase in typing speed.

FIGURE I summarizes the differences in means for speed and pspeed by grade level. The chart clearly shows that as the grade level increases, the keyboarding speed increases for both the pretest (speed) and the posttest (pspeed). Grade five, grade six, grade seven, and grade eight show the greatest increase in speed. Grade three and grade four also show an increase which appears to be significant. Grade two and grade nine show a decrease in keyboarding speed while grade one shows a moderate increase in speed and grade ten shows an insignificant gain. From TABLE I the grade ten and grade two levels were the only groups to not have a significant gain in keyboarding speed. The largest gain in speed occurs at the grade six level suggesting that this group is the

FIGURE I

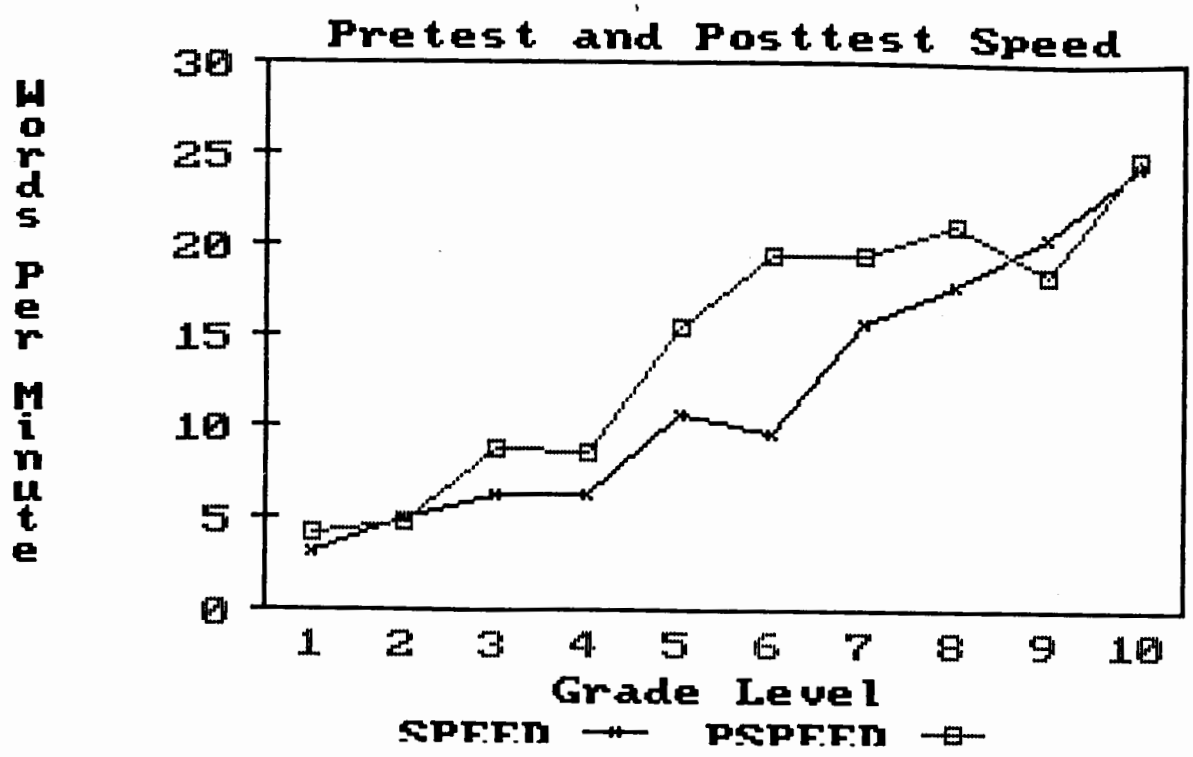
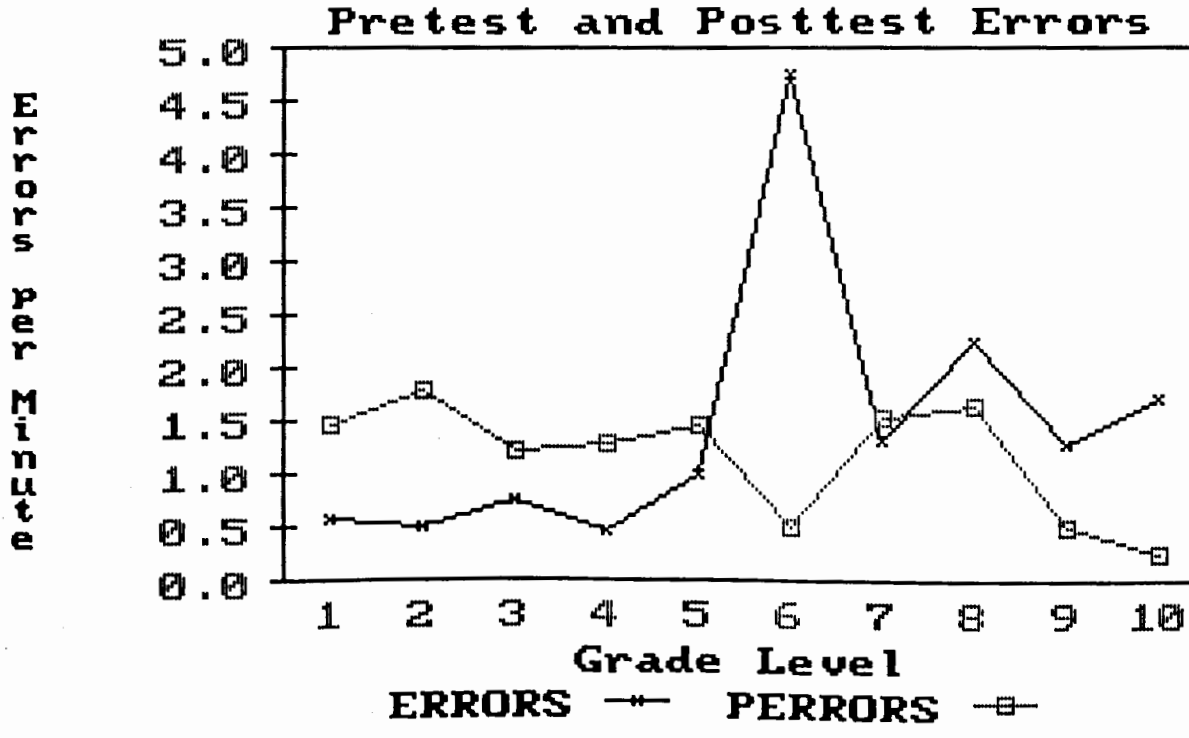


FIGURE II



ideal group to begin keyboarding instruction. The grade five and grade seven level also show significant gains in typing speed and therefore would also be good levels to begin keyboarding instruction. Grade eight students also show a significant gain in keyboarding speed but the increase is not as great as at the grade five, grade six and grade seven levels. There appears to be a natural dividing line for the increase in keyboarding speed. The first division is between the grade four and grade five levels and the second division is between the grade eight and grade nine levels. The first division group, grades one to four is the group with the lowest keyboarding speed after the posttest while the second division shows the greatest increase in keyboarding speed. The last group, the grade nine and grade ten levels showed no significant change in keyboarding speed. It would appear from TABLE III that the optimal group to begin keyboarding instruction is the middle group. Although the students in the lower grades in the first group, grade one, three and four did increase their speed, the graph shows that their speed is not high enough to warrant introducing instruction on the keyboard. The graph does indicate that these students did learn to keyboard but it is not the ideal situation for providing instruction.

for errors (pretest) and perrors (posttest) by grade level. The table shows that the average number of errors on the pretest for each grade level showed a slight increase starting at the grade five level. The grade six level showed an unusually large mean for errors but in the posttest the mean dropped well below the other grade levels with the exception of the grade ten level. Grade one, grade two, grade three, grade four, grade five and grade seven showed an increase in the number of errors from the pretest results to the posttest results. Grade six, grade eight, grade nine, and grade ten showed a decrease in the number of errors.

FIGURE II also shows that the differences between the means for grade three, grade five, grade seven, grade eight, and grade nine are not as great (not significant) as the differences at the other grade levels. These differences are shown not to be significant when looking at the p-value in TABLE I. Grade six showed the greatest improvement in the reduction of errors with grade ten showing the next greatest improvement. Improvement in the mean number errors begins at the grade six level, reinforcing the idea that the grade six level appears to be the ideal level to begin keyboarding instruction. The grade five level does not show a great (significant) increase for

the mean number of errors and could then also be a level to start keyboarding instruction. The grade levels below grade five show a greater increase in the mean number of errors and would not be considered an ideal place to begin instruction.

SUMMARY OF GRADE LEVEL POPULATION RESULTS

T-tests were used to determine whether there was a significant difference between the pretest and posttest scores for each grade level. Visual graphic representations also provided comparisons of groups and determining the differences between pretest and posttest scores. The results of the pretest and posttests for both speed and accuracy (errors) confirm the importance of teaching keyboarding at the appropriate level. It was found that the ideal time to begin keyboarding instruction was at the grade six level but the grade five level would also fall into this group. The grade levels below grade five showed an increase in typing speed but it was much lower than that achieved by the grade five level and higher.

CHAPTER FIVE

SUMMARY OF RESULTS

So little research has been done on the use of typing tutorials, that studies such as those which indicate the optimum age level at which to begin teaching keyboarding skill and/or word processing would contribute to that base of knowledge. (Gerlach, 1987)

Following on Gerlach's statement, a study of keyboarding was undertaken to determine the optimal level to introduce keyboarding, how to teach keyboarding and where to teach it. The study was intended to add to the base of knowledge about children and keyboarding skills.

From the results obtained, it is clear that all of the students involved in this research study were able to keyboard with some degree of efficiency. Some of the grade levels performed at a higher level than other grade levels. There were three distinct groups within the grade levels, plus two anomolous grades. The lower group, although able to keyboard, did not perform with a great deal of speed or accuracy nor did they reach a level of proficiency that would indicate learning keyboarding was optimal for these grade levels. Wetzel (1985) concluded that students who can type ten words per minute can make adequate use

of the computer for tasks requiring significant amounts of keyboard entry. This lowest group did not reach that level.

The middle level grades appear to be best suited for beginning keyboarding instruction as their speed and accuracy improved more than the other groups. The last group, the grade nine and grade ten levels, the grade ten level tended to concentrate more on the accuracy aspect of keyboarding rather than speed improvement. The grade nine level showed a significant decrease in their typing speed while their level of accuracy did not change significantly. The grade nine level showed they had more difficulty in increasing speed and accuracy with the introduction of new keys throughout the study.

Students improved their typing speed over the course of the study from a range of 2.9189 to 24.25 words per minute at the beginning of the study to a range of 4.0270 to 24.65 at the end of the study. The accuracy also improved which ranged from 0.4615 to 4.7143 at the beginning of the study to 0.2500 to 1.7561 at the end of the study. Even though there was an overall improvement for all grade levels together, the focus of this study was to determine when to formally teach keyboarding skills. From the results of

the pretest and the posttest, there is a linear trend for speed to improve with the increase in grade level. The mean number of errors tended to decrease as the grade level increased with the exception of the primary grades and grade four, where the mean number of errors increased on the posttest from the pretest results.

The grade two and grade nine level provided the only exception to these results, the mean number of errors did not increase significantly even though there was some apparent increase. This group did not follow the norms set by the surrounding grade levels.

CONCLUSIONS

There was support for the hypothesis that students could be formally trained to use the keyboard at any one of the grade levels tested. It was also supported that students above the grade four level were best suited for learning keyboarding skills at a fairly proficient rate of speed and accuracy.

Students in the grade one to grade four group did not progress to a level that would make optimal use of the computer. They did however learn the location of the keys and were able to improve their rate of speed over the twelve hour period. Accuracy did not

improve over the same period of time, and in most cases deteriorated. Students had learned more key locations and that may have affected the number of errors committed.

The grade nine and ten levels improved their accuracy at the expense of increasing their speed. The speeds obtained by the grade nine group decreased and the grade ten group only increased slightly but it was not a significant increase. Keyboarding speeds were sufficient at these levels and keyboarding instruction would not pose any difficulties.

RECOMMENDATIONS

From the results of this study, a formal keyboarding instructional program should begin around the grade five level. Students would be well able to manipulate the keys with some proficiency. With continued practice, students should continue to improve their speed and accuracy. Keyboarding instruction should not end with just the introduction of the keys, but should be used throughout the curriculum in order to reinforce the skill. If keyboarding instruction is discontinued at this point the ability to keyboard with some proficiency will deteriorate and will have to be reintroduced.

LIMITATIONS

This study had limitations. First, the number of hours used for keyboarding instruction was fairly short and could be increased to twenty hours or more. Second, the method used to teach the keyboarding was by teacher/textbook. Other methods are available such as typing tutor type programmes which may have helped students to become more proficient at the keyboard. Third, no emphasis was put on the use of the numeric keys, only the alphabetic keys, and the delete keys were used. It was not recommended to use the delete key but it was difficult to determine whether a student used the key without the knowledge of the teacher. The instructional materials used in this study were designed for teaching typing and not for teaching computer keyboarding.

Other research studies that could emerge from this study include a replication of this study over a longer period of time. A greater emphasis on practice between instructional sessions and a follow up on the uses of the computer after keyboarding instruction has been completed. Do students make better use of computers when they have had formal keyboarding instruction.

APPENDIX I

PRETEST/POSTTEST

Instructions:

Please use the following speed and accuracy test for timing students for both the pretest and the posttest.

Students are to be timed for one minute. Please signal to the students when they are to begin typing and after one minute have the students stop.

Please administer this test for three consecutive tries and record the average raw score (total number of strokes divided by three) for each student on the form enclosed. Do not identify the students, but simply write down the scores in any order.

Upon completion of the twelve hours of instruction, please administer the same test and record the scores in the second column.

Once both the pretest and posttest have been administered, please forward the completed forms to Fort Langley Junior Secondary School. Do not indicate the school or teacher on the score sheets or on the envelope.

PRETEST/POSTTEST

to it is in by of he so do on we if or a the

and for has she now can how why that when what

gone with from well some quite

I type very well when I do my best work.

My skill grows as I do my best each day.

KEYBOARDING RECORDS

GRADE________

STUDENT	PRETEST		POSTTEST	
	SPEED	ACCURACY	SPEED	ACCURACY

DATE_______________________________ HOURS OF KEYBOARDING__________________

APPENDIX II

PRETEST/POSTTEST RESULTS

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
1	18	0	10	19	0	10
2	17	0	10	18	0	10
3	20	3	10	19	1	10
4	22	0	10	21	0	10
5	21	9	10	21	0	10
6	13	0	10	16	0	10
7	12	0	10	13	0	10
8	13	5	10	16	1	10
9	16	0	10	17	0	10
10	15	4	10	17	0	10
11	35	2	10	35	0	10
12	34	2	10	33	1	10
13	37	2	10	36	1	10
14	41	1	10	42	0	10
15	39	1	10	39	0	10
16	24	1	10	23	0	10
17	24	0	10	22	0	10
18	27	1	10	23	1	10
19	30	2	10	32	0	10
20	27	1	10	31	0	10
21	17	1	9	16	0	9
22	17	0	9	16	0	9
23	18	7	9	17	0	9
24	19	4	9	18	0	9
25	19	2	9	17	0	9
26	15	0	9	15	0	9
27	10	5	9	10	0	9
28	10	0	9	9	4	9
29	12	0	9	12	0	9
30	15	0	9	13	0	9
31	14	2	9	13	0	9
32	25	0	9	22	0	9
33	24	0	9	21	2	9
34	32	1	9	23	0	9
35	36	0	9	37	2	9
36	34	2	9	26	0	9
37	24	0	9	21	0	9
38	20	0	9	19	0	9
39	19	4	9	18	0	9
40	20	0	9	19	1	9
41	24	0	9	19	1	9
42	23	0	9	19	1	9
43	14	6	8	16	2	8
44	14	4	8	16	1	8
45	14	3	8	16	0	8
46	15	0	8	17	0	8
47	14	8	8	17	0	8
48	14	6	8	17	0	8
49	14	0	8	16	0	8
50	14	0	8	15	1	8

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
51	13	4	8	15	1	8
52	14	3	8	16	0	8
53	14	2	8	16	0	8
54	14	0	8	16	0	8
55	15	0	8	17	0	8
56	16	0	8	18	0	8
57	16	0	8	18	0	8
58	16	0	8	17	2	8
59	16	1	8	18	1	8
60	16	1	8	18	1	8
61	16	1	8	18	1	8
62	15	3	8	17	1	8
63	15	1	8	17	0	8
64	15	0	8	17	0	8
65	16	0	8	17	1	8
66	16	0	8	17	1	8
67	15	9	8	17	1	8
68	8	0	8	11	0	8
69	8	0	8	11	0	8
70	8	0	8	11	0	8
71	10	0	8	12	0	8
72	10	0	8	12	0	8
73	9	0	8	11	0	8
74	5	0	8	10	0	8
75	5	0	8	8	1	8
76	4	1	8	7	0	8
77	8	0	8	11	0	8
78	7	1	8	10	0	8
79	7	0	8	10	0	8
80	10	2	8	12	1	8
81	12	0	8	14	1	8
82	11	7	8	14	0	8
83	11	3	8	14	0	8
84	13	0	8	15	0	8
85	12	2	8	15	0	8
86	12	0	8	15	0	8
87	10	4	8	13	0	8
88	10	4	8	12	2	8
89	10	3	8	12	1	8
90	11	1	8	14	0	8
91	11	0	8	14	0	8
92	11	0	8	13	1	8
93	24	0	8	30	0	8
94	23	6	8	30	0	8
95	23	0	8	29	4	8
96	24	14	8	30	12	8
97	24	2	8	30	6	8
98	24	2	8	30	4	8
99	22	0	8	27	0	8
100	21	4	8	26	4	8

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
101	21	3	8	26	4	8
102	23	0	8	29	4	8
103	22	9	8	27	4	8
104	22	6	8	27	1	8
105	26	5	8	30	14	8
106	35	0	8	39	6	8
107	32	0	8	37	2	8
108	31	1	8	36	5	8
109	51	3	8	45	1	8
110	42	0	8	44	1	8
111	36	0	8	41	8	8
112	27	0	8	34	2	8
113	26	10	8	34	2	8
114	26	9	8	33	1	8
115	31	0	8	35	6	8
116	30	0	8	35	6	8
117	29	2	8	34	6	8
118	17	11	8	21	3	8
119	17	10	8	21	2	8
120	17	8	8	21	2	8
121	18	7	8	23	0	8
122	18	0	8	23	0	8
123	18	0	8	22	0	8
124	17	0	8	20	0	8
125	16	4	8	19	1	8
126	16	3	8	19	0	8
127	17	5	8	21	2	8
128	17	0	8	21	2	8
129	17	0	8	21	1	8
130	19	1	8	23	1	8
131	21	0	8	25	3	8
132	20	6	8	25	0	8
133	20	2	8	24	3	8
134	21	0	8	26	1	8
135	21	0	8	25	3	8
136	21	0	8	25	3	8
137	20	0	8	23	2	8
138	19	5	8	23	2	8
139	19	3	8	23	1	8
140	20	1	8	24	3	8
141	20	1	8	23	3	8
142	20	0	8	23	2	8
143	11	4	7	15	2	7
144	11	6	7	16	0	7
145	11	15	7	16	0	7
146	11	3	7	15	0	7
147	11	0	7	14	4	7
148	11	1	7	14	8	7
149	11	2	7	15	0	7
150	12	0	7	16	0	7

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
151	12	4	7	16	3	7
152	12	4	7	16	4	7
153	13	0	7	17	1	7
154	12	3	7	16	1	7
155	12	0	7	16	0	7
156	12	1	7	16	1	7
157	12	1	7	16	1	7
158	9	3	7	10	4	7
159	9	4	7	10	4	7
160	9	4	7	11	3	7
161	8	1	7	10	2	7
162	5	1	7	8	0	7
163	7	0	7	8	0	7
164	8	0	7	10	0	7
165	10	0	7	11	3	7
166	10	2	7	14	2	7
167	10	4	7	14	2	7
168	11	0	7	14	3	7
169	10	1	7	14	0	7
170	10	0	7	12	2	7
171	10	1	7	13	0	7
172	10	1	7	14	0	7
173	22	1	7	26	0	7
174	23	0	7	26	5	7
175	23	0	7	26	9	7
176	22	0	7	26	0	7
177	21	1	7	24	2	7
178	22	0	7	24	3	7
179	22	0	7	25	0	7
180	23	0	7	27	2	7
181	26	0	7	35	0	7
182	28	0	7	36	0	7
183	30	1	7	42	10	7
184	25	1	7	32	0	7
185	24	0	7	29	0	7
186	24	0	7	30	0	7
187	25	0	7	31	0	7
188	15	0	7	20	1	7
189	15	2	7	20	1	7
190	16	0	7	21	0	7
191	15	0	7	20	0	7
192	13	1	7	18	0	7
193	14	0	7	18	0	7
194	14	3	7	19	1	7
195	16	0	7	21	0	7
196	20	2	7	23	0	7
197	21	0	7	23	6	7
198	21	0	7	24	0	7
199	20	0	7	23	0	7
200	18	1	7	21	1	7

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
201	19	0	7	22	0	7
202	20	0	7	22	1	7
203	8	5	6	16	0	6
204	8	3	6	15	0	6
205	8	1	6	15	0	6
206	8	17	6	16	0	6
207	9	5	6	20	0	6
208	9	2	6	19	0	6
209	9	1	6	18	1	6
210	6	0	6	12	0	6
211	5	4	6	10	4	6
212	3	1	6	*	*	6
213	6	2	6	13	0	6
214	8	1	6	14	0	6
215	7	0	6	13	1	6
216	6	3	6	13	1	6
217	12	15	6	23	1	6
218	12	6	6	23	0	6
219	12	1	6	23	0	6
220	13	10	6	24	0	6
221	15	2	6	30	0	6
222	15	1	6	28	0	6
223	14	5	6	25	1	6
224	10	3	6	21	0	6
225	10	2	6	21	0	6
226	9	6	6	20	2	6
227	10	7	6	21	1	6
228	11	21	6	22	1	6
229	11	5	6	22	0	6
230	11	3	6	22	0	6
231	8	1	5	12	1	5
232	8	1	5	12	1	5
233	8	1	5	12	2	5
234	8	1	5	12	2	5
235	8	0	5	12	0	5
236	7	4	5	11	6	5
237	7	4	5	11	4	5
238	8	0	5	12	0	5
239	7	11	5	12	0	5
240	8	3	5	12	2	5
241	9	1	5	13	3	5
242	9	1	5	13	0	5
243	10	0	5	14	0	5
244	9	2	5	13	3	5
245	9	0	5	13	0	5
246	9	0	5	12	3	5
247	9	0	5	12	3	5
248	9	0	5	12	4	5
249	9	0	5	12	3	5
250	6	0	5	7	2	5

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
251	6	0	5	6	0	5
252	6	1	5	8	2	5
253	6	0	5	8	1	5
254	6	0	5	6	0	5
255	5	0	5	4	2	5
256	5	0	5	4	0	5
257	6	0	5	5	0	5
258	5	1	5	5	0	5
259	7	0	5	9	3	5
260	7	1	5	11	0	5
261	7	0	5	11	0	5
262	7	2	5	11	1	5
263	7	1	5	11	1	5
264	7	0	5	11	0	5
265	7	0	5	9	4	5
266	7	0	5	9	4	5
267	7	0	5	10	1	5
268	7	0	5	10	1	5
269	15	0	5	23	0	5
270	14	2	5	22	2	5
271	16	0	5	23	2	5
272	15	1	5	23	2	5
273	13	2	5	22	1	5
274	13	0	5	21	1	5
275	12	3	5	21	0	5
276	13	1	5	22	0	5
277	13	1	5	22	0	5
278	17	1	5	23	2	5
279	20	0	5	26	0	5
280	19	2	5	25	1	5
281	21	2	5	33	0	5
282	20	0	5	26	3	5
283	19	0	5	25	1	5
284	18	2	5	24	2	5
285	18	0	5	24	0	5
286	19	0	5	25	1	5
287	18	4	5	25	0	5
288	11	0	5	15	5	5
289	11	0	5	15	2	5
290	11	0	5	17	1	5
291	11	0	5	16	4	5
292	10	8	5	15	2	5
293	10	0	5	14	1	5
294	10	0	5	14	0	5
295	10	2	5	14	3	5
296	10	1	5	14	1	5
297	11	0	5	17	2	5
298	12	1	5	20	1	5
299	12	1	5	20	1	5
300	12	1	5	21	0	5

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
301	12	1	5	20	2	5
302	12	0	5	20	0	5
303	11	1	5	18	1	5
304	11	1	5	17	3	5
305	12	0	5	18	2	5
306	12	0	5	18	2	5
307	5	0	4	6	1	4
308	5	0	4	6	1	4
309	5	0	4	6	1	4
310	5	0	4	6	1	4
311	5	0	4	6	1	4
312	5	1	4	7	0	4
313	6	0	4	7	1	4
314	5	0	4	6	2	4
315	5	1	4	6	3	4
316	4	2	4	6	1	4
317	3	0	4	4	0	4
318	3	0	4	4	1	4
319	2	0	4	*	*	4
320	2	0	4	4	0	4
321	4	0	4	5	1	4
322	4	1	4	6	0	4
323	4	1	4	6	0	4
324	4	0	4	6	0	4
325	4	0	4	6	0	4
326	6	0	4	8	1	4
327	9	0	4	12	2	4
328	9	1	4	12	2	4
329	8	1	4	12	0	4
330	9	0	4	12	1	4
331	9	1	4	12	3	4
332	12	0	4	13	2	4
333	12	0	4	14	4	4
334	10	1	4	12	4	4
335	11	2	4	13	1	4
336	8	1	4	11	2	4
337	6	1	4	9	1	4
338	6	1	4	9	4	4
339	6	0	4	8	1	4
340	6	1	4	8	1	4
341	7	0	4	10	0	4
342	7	1	4	10	3	4
343	8	0	4	11	0	4
344	7	0	4	10	1	4
345	7	1	4	10	1	4
346	5	1	3	7	2	3
347	5	1	3	6	2	3
348	5	1	3	7	2	3
349	5	2	3	8	3	3
350	5	1	3	8	0	3

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
351	5	0	3	6	0	3
352	4	0	3	*	*	3
353	2	1	3	*	*	3
354	5	0	3	5	0	3
355	5	0	3	6	0	3
356	5	0	3	5	1	3
357	8	2	3	11	1	3
358	8	2	3	11	0	3
359	9	0	3	11	1	3
360	10	1	3	12	1	3
361	9	1	3	12	0	3
362	8	1	3	10	3	3
363	6	0	3	9	1	3
364	6	0	3	8	3	3
365	6	0	3	9	2	3
366	7	2	3	10	1	3
367	6	0	3	10	1	3
368	4	0	2	3	3	2
369	4	1	2	3	3	2
370	3	1	2	3	3	2
371	3	1	2	3	1	2
372	3	1	2	3	1	2
373	5	0	2	4	1	2
374	5	0	2	4	2	2
375	4	2	2	4	1	2
376	4	1	2	4	0	2
377	4	2	2	4	0	2
378	3	1	2	3	1	2
379	2	0	2	2	1	2
380	2	0	2	2	2	2
381	2	0	2	2	1	2
382	1	0	2	*	*	2
383	2	0	2	*	*	2
384	3	0	2	3	0	2
385	3	1	2	3	0	2
386	3	0	2	3	0	2
387	2	1	2	3	0	2
388	2	1	2	3	0	2
389	5	0	2	5	1	2
390	8	0	2	6	5	2
391	8	0	2	7	1	2
392	8	0	2	6	5	2
393	6	1	2	6	2	2
394	6	1	2	6	5	2
395	9	0	2	7	2	2
396	10	0	2	7	7	2
397	9	0	2	7	2	2
398	8	0	2	7	1	2
399	8	1	2	7	2	2
400	6	1	2	6	1	2

PRETEST/POSTTEST SCORES BY GRADE

	SPEED	ERRORS	GRADE	PSPEED	PERRORS	PGRADE
401	5	1	2	5	3	2
402	6	0	2	5	3	2
403	5	1	2	5	3	2
404	5	0	2	5	2	2
405	5	0	2	5	2	2
406	6	0	2	6	1	2
407	6	1	2	6	1	2
408	6	0	2	6	1	2
409	6	0	2	6	1	2
410	6	0	2	6	1	2
411	2	1	1	3	1	1
412	2	1	1	3	2	1
413	2	0	1	3	1	1
414	2	1	1	3	1	1
415	2	1	1	3	2	1
416	3	0	1	4	0	1
417	3	0	1	4	0	1
418	2	1	1	3	2	1
419	2	1	1	3	2	1
420	2	0	1	3	0	1
421	2	0	1	3	0	1
422	1	0	1	2	1	1
423	1	0	1	2	2	1
424	2	0	1	3	0	1
425	2	0	1	3	0	1
426	2	0	1	3	1	1
427	2	0	1	3	0	1
428	2	0	1	3	0	1
429	3	0	1	4	0	1
430	4	1	1	5	2	1
431	4	1	1	5	3	1
432	4	1	1	5	1	1
433	4	1	1	5	1	1
434	5	0	1	5	3	1
435	5	2	1	7	0	1
436	6	2	1	11	11	1
437	5	1	1	6	1	1
438	5	1	1	6	1	1
439	3	0	1	4	1	1
440	3	0	1	4	1	1
441	3	0	1	4	1	1
442	3	0	1	4	1	1
443	3	0	1	4	2	1
444	3	1	1	4	2	1
445	3	1	1	4	3	1
446	3	1	1	4	2	1
447	3	1	1	4	2	1

APPENDIX III

WORKSHOP OUTLINES

WORKSHOP I

The objectives of this first workshop are:

1. To familiarize you with computer hardware
2. To show you how to load your software
3. To show you how to save your documents
4. To help you feel comfortable with other housekeeping tasks such as printing documents
5. To introduce you to the new keyboarding program

WORKSHOP II

The objectives of this second workshop are:

1. how to begin teaching keyboarding
2. techniques that are important
   - posture
   - finger positions
   - body position
3. why monitoring students is important
4. evaluation of keyboarding skills

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