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A CRITICAL EXAMINATION OF SOME FACTORS AFFECTING WORD PROCESSING PRODUCTION PERFORMANCE

By

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "A Critical Examination of some Factors Affecting Word Processing Production Performance" submitted by B. Helen Koch in partial fulfillment of the degree of Master of Science.

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ABSTRACT

For the last 90 to 100 years, the typewriter has been used in business as the main tool for producing written documents. In the 1980s, however, it is rapidly being replaced by the word processor. Since the major objective of all typewriting instruction is to prepare students to produce documents accurately and quickly, business educators must now reassess their teaching procedures and develop new methodologies to teach those skills that will be needed for word processing.

The purpose of this study was to examine some factors which may be related to word processing performance in order to determine those which are important for fast and accurate production work. A further objective was to examine the relative importance of speed and accuracy skill development in keystroking skills needed for word processing use.

To determine how keystroking skills affected word processing, the students' keystroking speed and accuracy skills were measured both in a copy typing situation and in a manuscript production format on a word processor. To determine how computer skills affected word processing performance, students' aptitude for programming and computer literacy knowledge were assessed. Finally, to determine how attitudes related to word processing performance, attitudes to both computers and word processing were determined.

A sample of 31 grade 12 students from three high schools took part in the experiment. In all cases, the word processor WordPerfect was used on the Olivetti M-24 microcomputer.

Analysis of the data indicated that keystroking speed was strongly related to word processing production speed; that keystroking accuracy was related to word processing accuracy for more complex tasks; that knowledge of computer literacy was related to word processing production accuracy (but not speed) when the jobs became more complex; that attitude to word processing was slightly related to word processing production speed (but not accuracy); and that aptitude for programming and attitude to computers had little effect on word processing production speed or accuracy.

It was concluded that, for this sample, keystroking speed strongly affected word processing speed; and that keystroking accuracy, computer literacy knowledge, and attitude to word processing affected word processing production work when the tasks were more complex.

An analysis of some keyboarding courseware packages currently available showed that accuracy was stressed in keystroke learning in most cases. The relative emphasis placed on speed and accuracy in the majority of these CAI programs was not consistent with the findings of this research study.

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CHAPTER I

INTRODUCTION

Forty years ago, few people had heard of the computer. Today, computers combined with the communication technology of television, telex, telephones, cable, transmitters and satellites are responsible for about half the work done in North America (Menzies, 1982). Indeed, for many years now, the information processing and computational work done by computers in the world could not be carried out by hand. In 1984, Shelly and Cashman estimated that it would take 400 billion people, many times the world population, to undertake this workload.

The impact of computers on the world is extensive. Initially computers were available only to select groups, but since the microcomputer was developed, this technology has become available to all sectors of society. Today there is hardly an industry, profession, or even an activity that has not been changed or affected in some way. We are in the midst of a Computer Revolution, and it is happening in a very short span of time. It is a revolution because computers not only add to society's traditional constitution, but they also transform society by automating many activities that currently provide employment for people, yet at the same time create a large number of new activities and opportunities that could provide new sources of employment.

Business has been involved with computers almost from the beginning of the technology. The first large-scale digital electronic computer, the ENIAC (Electronic Numerical Integrator and Computer), was completed in 1945/46. It was built for military purposes and was never used for any business applications. However, only five years later, computers were built under contract for commercial customers (Williams, 1985) and were used for business rather than for scientific, military, or engineering applications. Computers like the Mark I developed at Manchester University in England and the UNIVAC (UNIVersal Automatic Computer) built for the U.S. Census Bureau's use were sold to both government and industry to perform a wide variety of commercial tasks. Even at this very early stage of the technology, computers were already found to be necessary both for processing increasing amounts of information and for numeric calculations.

Further developments in computer technology enhanced the use of computers in business. In 1960, COBOL (COmmon Business Oriented Language), a high-level language developed specifically for business applications, made it easier and faster for programs to be written for business use. In 1964, the development of the word processor by the IBM Corporation heralded the beginning of office automation. In the 1970s, the invention of the microcomputer meant that every business, even the small ones, could afford a computer. Today, computers are used in business more than they have ever been used before, and their use is still increasing.

The word processor has greatly transformed offices. Since word processing was introduced in the 1960s, it has grown into a multibillion dollar business in North America (Anderson, R.I., 1980). The technology and use of word processing in business has progressed so rapidly that it is predicted by some people that word processors will almost eliminate the use of conventional typewriters in work situations by the end of the 1980s. Whether or not this will actually happen, it is already clear that the use of conventional typewriters is likely to drop at an accelerating rate hereafter, to be replaced by word processors (West, 1983).

High school business educators prepare students to work in business. One of the objectives of the Alberta High School Business Education Program is to provide for the development and acquisition of business knowledge and skills which will be most useful and durable in a rapidly changing society (Alberta Education, 1985). Because business is moving very quickly from the use of typewriters for producing written documents to the use of word processors, business educators must now provide the opportunity for students to acquire the knowledge and skills that they will need to work with word processors.

The Problem

When typewriters were used to produce written documents, certain skills were developed that allowed the user to type most effectively and efficiently. Teachers developed methodologies and strategies to teach these needed skills.

The word processor uses a very different technology from that of the typewriter. Instead of being a mechanical machine, it is an electronic device, and as such, has many advantages over the typewriter. Even though the word processor is being used for the same purpose as the typewriter, namely, to produce written documents, the differences in technologies imply that there will also be differences in the skills needed. If indeed there are differences in the required skills for word processing from that of typewriting, then there will also be differences in the methods that should be used to teach the required skills to students. However, little research has been done on word processing instructional methodology or skill development (West, 1983).

To ascertain if there are any differences between the required skills for producing written documents on typewriters and on word processors, it is first necessary to determine the skills in each case. The skills for the former are fairly well known since the typewriter has been in use for many years. However, less is known about the required skills of the latter. This research, therefore, was designed to investigate some factors which are related to the successful production of written documents on a word processor.

Definition of Terms

The following are definitions of terms used in this study:

Computer Literacy is the understanding, skills and attitudes needed to function effectively within given social roles that directly or indirectly involve computers.

Gross Words Per Minute (gwpm) is a measure of typing speed that ignores errors. It is determined by dividing the total number of strokes by five, and then dividing the result by the number of minutes typed.

Keyboarding is the act of keystroking on a computer keyboard input device.

Keystroking refers to the skill of striking the correct key accurately and quickly.

Other Errors refer to errors made in production work that are not incorrect keystrokes, but are errors that affect the placement of the text on the page. Examples are incorrect format or deletion of headings.

Production Work refers to the typing of real-life jobs such as manuscripts, letters, and tables.

Straight-Copy Timing refers to the typewriting of lines of text where no formatting decisions need be made during the typing.

Syllabic Intensity is one way of measuring difficulty of text. It is determined by dividing the total number of syllables by the number of real words. The higher the syllabic intensity, the more difficult the copy is to type.

Typewriter is a machine for writing in characters similar to those produced by printers' types, by means of type striking through an ink ribbon.

Typist is the person who operates any kind of typing machine, mechanical or electronic.

Typographical Error refers to the kind of error typically made by striking the wrong key. It generally does not affect the placement of text on the page. Examples are: an incorrect keystroke or word division, a strikeover, incorrect paragraph indentation, or incorrect spacing for punctuation marks.

Word Processing refers to the act or art of using a computer to carry out typewriting tasks.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The processing of information has been important throughout history. When people needed to make tabulations, keep records, or run manufacturing processes, they looked for tools to make their work easier.

Information can be grouped into four basic categories: text (words), data (numbers), images (charts, graphics, etc.), and voice (Stallard, Smith and Reese, 1983). The processing of words began in 3300 BC when the Babylonians used sharp styli to etch hieroglyphics onto soft clay tablets which eventually hardened and became a preserved record (Barton, 1985). The methods of processing changed in time, becoming more technologically complex with the use of ink, parchment, paper, the printing press, and the typewriter.

As the use of technology has progressed, there has been a growing need to teach people how to use it. Therefore, when the use of the typewriter became more widespread, methodologies for teaching typewriting evolved. In order to understand this evolution, it is necessary first to examine the development of the technology.

This chapter opens with an account of the development of the typewriter and how the methods of correcting errors changed. This is followed by a section which shows that when the typewriter became inadequate, technological advances in the field of data processing were used to develop the word processor. The next section relates the skills required by typists, and the methodologies and strategies used by business educators to teach them, to specific inventions and significant developments in the available technology. Finally, the skills which are perceived today in business and by business educators as being important for the word processor operator are enumerated.

Development of the Typewriter

The first recorded mention of the typewriter was in 1714, when Henry Mill was granted a British patent for:

> An Artificial Machine or Method for the Impressing or Transcribing of Letters Singly or Progressively one after another, as in Writing, whereby all Writing whatever may be Engrossed in Paper or Parchment so Neat and Exact as not to be distinguished from Print (I.S.L., Typewriter, 1971, p. 442).

Since no drawings of Mill's machine exist, and its construction is not known, there is very little information on this machine.

By the mid-1800s, a variety of typewriter-like machines had been developed, incorporating some of the rudimentary features that characterize the modern machine. Most were so large and inefficient that it took more time to type than was needed to write by hand. However, the benefits of clarity, uniformity, and potential use of the typewriter by handicapped individuals were recognized, and spurred further efforts towards improvement (Cooper, 1983).

The first practical model was constructed by Christopher Latham Scholes and two colleagues in Milwaukee in 1868. It could write well at a speed far exceeding that of the pen, but it was still quite crude, lacking the keyboard layout, typewriter carriage, and cylinder or platen of the typewriters of today. Many improvements of this machine followed; and in early 1874, the Scholes machine (soon renamed the Remington Typewriter) was placed on the market for sale. Among its original features which are still standard in some machines of today were:

> The cylinder with its line-spacing and carriage-return mechanism, the escapement which cause the letter spacing by carriage movement, the arrangement of the type bars so as to strike the paper at a common centre, the actuation of the type bars by means of key levers and connecting wires, printing through an inked ribbon, and the positions of the different characters on the keyboard, which conform almost exactly to the arrangement that is now universal (I.S.L., Typewriter, 1971, p. 442).

A number of further refinements of the typewriter followed: use of the shift key, to produce lower as well as upper case characters (in 1878); appearance of type that was immediately visible to the operator (in 1883); and the first modern electric typewriter (in 1920) which was developed from Thomas Edison's first electrically-operated typewriter of 1872 (I.S.L., Typewriter, 1971). The incorporation of electricity in the typewriter design made it more versatile so that it formed the basis for other devices such as accounting machines, which performed complete bookkeeping functions; various composing machines, which used different font styles and sizes, proportional spacing of characters in a word, and right justification of text; and the integration of the typewriter with the computer, such as terminals and printers.

A noiseless typewriter was introduced in the early 1930s by Remington Rand, Inc. It was not totally without noise, but it was quieter than the other typewriters on the market at that time. Facit of Sweden, Underwood-Olivetti of Italy, and Olympia, Adler and Triumph of Germany all marketed their versions of the Noiseless Typewriter. However, it enjoyed only limited success and is not used today (Merrill, 1985).

The typewriter design changed again in 1961 when International Business Machines (IBM) introduced the Selectric, an electric typewriter without a moveable carriage. Instead, it had a sphere-shaped element which moved across the paper, tilting and rotating as it selected the required symbol. This was the last major technological change of the mechanical typewriter.

In the production of a written document, however, a typist uses not only the typewriter but also devices that are available to correct errors. Therefore, it is also necessary to examine the development of error correction devices.

Typographical Error Correction on the Typewriter

In the hundred year period that the typewriter has been in use, the methods of correcting typographical errors have changed considerably.

The earliest correction device was the pencil eraser. The first mention of it in the literature occurred in 1752 when it was suggested that caoutchouc, a vegetable gum produced by certain South American trees, might be used to erase black lead marks. In 1770, an English chemist, Joseph Priestly, named it rubber because it was used to rub out marks (Eraser, 1986).

However, all the early manufactured rubber products including the pencil eraser shared one defect; namely, they were subject to temperature changes. In warm temperatures they became soft and sticky, and in cold ones they became brittle. This made the eraser impractical to use. However, in 1839, the American inventor Charles Goodyear overcame this difficulty when he discovered the process of vulcanization. Named after Vulcan, the Roman god of fire, the process involved the mixing of sulphur into rubber and the heating of the mixture to bring about a chemical reaction. The resulting rubber retained the same consistency regardless of temperature changes. This made the pencil eraser much more practical to use, particularly after 1858, when Joseph Rechendorfer of New York City patented the pencil with an eraser on its tip (Eraser, 1986).

Nevertheless, until the 1930s the erasers that were available were suitable only for erasing pencil marks. It was not until powdered pumice or other similar material was added to the composition of the eraser that it was possible to erase ink marks. These erasers removed both the ink mark and a layer of the paper, exposing a clean surface (Établissements P. Orange et Cie, 1930, and Jones, W.E., 1939). Therefore, for the first time erasers could be used to rub out typographical errors made on a typewriter.

Pencil and ink erasers have continually been improved and refined since that time, resulting in erasers that have greater erasing efficiency with less smearing and less waste (Chemical Abstracts, 1946-1972).

Erasers, however, were not the only method developed for correcting typographical errors. Although they were the first method invented, and were used for quite a long time, there were some problems with using erasers as a device to correct typographical errors. First, it was too time-consuming, in that it took about 30 seconds to make a neat correction of a simple misstroke on an original copy (McLean, 1984).

Second, the typographical error often could not be erased neatly, thus necessitating the re-typing of the page. As a result, more efficient methods of correcting errors were devised in the past 20 years.

As the Chemical Abstracts (1964 to 1980) show, there were basically three ways of covering up (masking) a typographical error.

1. <u>Chalk-backed correction strips tape</u> (1964)

   To correct a typographical error using this method, the typist backspaced to the error, placed the tape over the error, and typed the error again. This coated the black ink of the error with a white chalky substance, effectively covering it up. Then the typist entered the correct character on top of the masked error.

2. <u>Typewriter ribbons for correction</u> (1965)

   This method was very similar to that of the tape. It consisted of a chalk-backed ribbon which was threaded into the typewriter behind the ink ribbon. When an error was made, the typist backspaced to the error and pressed an error correction key followed by the incorrect character that had been typed. This coated the black ink of the error with a white chalky substance, covering it up. Then the typist entered the correct character on top of the masked error.

3. <u>Correction Fluid</u> (1970s)

   To correct an error using this method, a liquid substance was lightly painted over the error. When it was dry, the correct character was typed on top of the dried paint.

Correcting an error by covering it up took approximately five seconds (West, 1983). This was much faster than using the eraser, but the corrections were of a poor quality.

The lift-off tape, developed in 1978 and used in conjunction with carbon ribbons, is the most efficient means of correcting errors. No covering up is required since the tape actually removes the carbon particles of the incorrect character from the paper. This method takes only seconds to make a correction which is virtually impossible to detect.

Thus, it can be seen that both typewriter technology and typographical error correction have gone through several changes since the first typewriter was placed on sale in 1874.

The Word Processor

The Need for Word Processing

Since the late 1800s and until very recently, the typewriter has been the principal means of preparing written business communications. Over the years, the written communications needed to operate a business have steadily increased due to the need for more information in more businesses, the proliferation of government regulations, and advancements in transportation and communication (Ellis, 1980).

To keep up with the increased paper volume, more and more office personnel were employed. As personnel costs continued to escalate, the processing of written information became more expensive. In the United States, approximately 75% of office costs were related to labour (Bergerud and Gonzaliz, 1981). Therefore, there was a pressing need to reduce personnel costs.

At the same time, there was also a pressing need to improve the low productivity rates. In the early 1960s, the typewriter had not greatly changed since 1920. Methods of correcting typographical errors were limited to the use of the ink eraser which took too long and produced limited results. There was no way of correcting other errors except by re-typing the page or document. Thus, although more people were hired to handle more paperwork, there was little change in the productivity of office workers (Stallard, Smith and Reese, 1983).

To increase productivity and thereby reduce office costs, once again a solution was sought in technology. What was needed was a device on which both typographical and other errors could easily be corrected, thus reducing to a minimum time spent on correcting errors and changing text. This technology in fact already existed in the field of data processing.

Data Processing Typewriting

In the 1940s and 1950s when the first computers were being built and used, the available technology for processing text was the typewriter. A way had to be found to input data into the computer memory. Typewriter technology was incorporated into the design of machines to prepare the data for input.

Early computers used the typewriter in two different ways as an input device (Sterling and Pollock, 1970, and Wooldridge, 1974):

1. Typing data on an External Medium

Punched Cards: Nearly all the computers in those early days which were utilized for business applications used punched cards to input data. A typist recorded data on the cards by using a keypunch machine with a typewriter keyboard and a punching mechanism. As the operator typed, small holes were punched in the card. When the typist had completed all the cards, they were usually typed again, this time on a verifier machine to check the accuracy of the original typing. It was hoped that the typist would not make the same error twice.

When the cards had been both punched and verified, they were read into computer memory by a card reader. This reader sensed the presence or absence of holes in predefined places on the card and converted the observed patterns to electronic signals.

If at any time in this process an error was found on a card, it had to be re-typed.

Magnetic Tape: This input device consisted of a tape onto which data could be recorded and at a later time recalled. To record data, a typist used a key-to-tape encoder or converter, similar to a keypunch machine, which had a typewriter-like keyboard. As the operator typed, the machine converted the characters to the appropriate magnetized coding on the tape. Tapes encoded in this manner could be verified and edited.

Magnetic Disk: This input medium consisted of a series of circular plates similar to phonograph records rotating on a central vertical shaft. A typist used a key-to-disk recorder, very similar to the key-to-tape encoder for magnetic tape.

It must be noted here that data could be placed on these external media both by a typist and by the computer. The typist entered programs and input data onto the punched cards, magnetic tape or magnetic disk while the computer stored its output data on the same media (Stern and Stern, 1973).

Even while these methods of entering data into the computer were being developed and used, it was realized that typing data on some external medium and then reading it into the computer was slow and expensive in that it did not allow for immediate user interaction with the computer.

2. Typing Directly into Computer Memory

For this method of input, data preparation and input operations were combined. Using a print (hard copy) terminal, a person typed from the typewriter-like keyboard, which not only sent the appropriate electronic signals to the computer, but also printed a copy of the text at the terminal.

Terminals allowed user interaction with the computer, but print terminals were rather slow. In the 1950s and 1960s the Cathode Ray Tube (CRT) display unit was developed and refined for use with the computer. It consisted of a visual display device similar to a television screen and a typewriter-like keyboard (Spencer, 1978). When the typist pressed a key, the character was sent to the computer and was printed directly on the screen.

A CRT terminal made it possible to display data much more quickly on the screen than it could be printed on the hard-copy terminal.

Originally, to correct or change a line on the CRT screen, the user had to retype the entire line, much like re-typing a punched card. However, because the data were entered on a screen electronically instead of on paper with ink, it was soon realized that the less permanent method of electronic data allowed for more efficient error correction. Still using the idea of correcting one line at a time, however, utility programs called line editors were developed. These utilities allowed the user to edit one line of text at a time, by adding, deleting, or changing text on that line. Thus, if an error were made, the user could display the line and change only the error, rather than type the entire line over again.

It was soon realized that it would be much more efficient if a user were able to manipulate text within the document rather than just within one line; that is, have text editing facilities rather than just line editing ones. Text (screen) editors were developed, therefore, as computer utility programs that allowed a user to enter, alter, format, and store program and manuscript text (Van Dam and Meyrowitz, 1983). Thus, the user was able to move anywhere in the document to create, revise, and maintain text as needed. Text editing made the entry, editing, and debugging of programs much faster and more efficient.

Development of the Word Processor

An information processing machine was needed to increase productivity by making correction of text easier and faster.

In the data processing field, computer hardware which could store large amounts of data for later retrieval, combined with computer software in the form of text editors which could be used to change any of that data, were in common use. From this existing technology the word processor was developed. Indeed, word processing has been called a synonym for commercial text processing (Van Dam and Meyrowitz, 1983).

The term Word Processing was first used in 1964 by IBM at the International Business Machines World Trade Corporation in Germany. It is a literal translation of the German word "Textverarbeitung." IBM used the term to describe its new typewriter, the IBM Magnetic Tape Selectric Typewriter (MT/ST), which could record words on magnetic tape (Ellis, 1980). This was the first typewriter that used computer technology. Text typed on this machine was simultaneously stored on a magnetic tape that could be "read" subsequently by an attached unit that caused the typewriter to reproduce the message. It also meant that revisions could be made on a limited basis.

In 1969, IBM introduced the Mag Card Selectric word processor and soon afterwards coupled the magnetic card with an electronic memory device capable of storing up to 8000 characters. In 1974, IBM developed the IBM Memory Typewriter which had text editing and allowed the storage of up to 50 pages of copy (Merrill, 1985). It was this machine that was the forerunner of today's stand-alone word processors. Other vendors began to develop and market word processing hardware and software. A cathode ray tube display unit was added to the basic keyboard which allowed additional flexibility in the manipulation of the text copy and format. The storage media was expanded to include not only magnetic tape and cards but also floppy disks, hard disks, and the mainframe computer (Stallard, Smith and Reese, 1983).

Today, the word processor has full screen editing with easy manipulation of text. Both typographical and other errors can easily and quickly be corrected with minimal re-typing of the document. Thus, word processors allow office personnel to rapidly create, manipulate, and output text. In addition, many also offer features other than editing and file handling. Some word processors have limited data processing capabilities such as the ability to sort and select records or perform arithmetic calculations. Many include a speller for checking the correct spellings of words, and now some of the newer word processors have a thesaurus for finding correct synonyms. Features are continually being added in an effort to provide more facilities to enhance the production of text documents.

Teaching Strategies for Skill Development on the Typewriter

Since the development of the typewriter and error correction devices, there have been various teaching strategies for skill development. They have been divided into three periods of time, each period representing a different strategy and related to major changes in the technology.

1874 - 1919

These years encompassed the major development of the typewriter from a crude, cumbersome machine to one that had many features which are still standard today. Very little in the way of error correction facilities was available as the pencil eraser was the only one invented at this time. Therefore, during this period, the operator had to type very accurately because any one error made, whether it was typographical or other, resulted in the re-typing of the entire page.

The first typists in the 1870s and early 1880s used a hunt-and-peck method with a single finger of each hand. The use of all fingers, however, was first advocated in 1882 by Mrs. L.V. Langley of Cincinnati, Ohio; and the modern method of touch typing just a few years later by Frank E. McGurrin of Salt Lake City, Utah. By 1900, most typewriting schools had adopted this method (Cooper, 1983).

Regardless of the method of typing used, Hart (1971) in her dissertation on terminology and associated methodology of the skills used in teaching beginning typewriting found that "It was believed that absolute accuracy should be the rule in the beginning, and that it should be insisted on throughout the course" (p. xii). Accuracy was considered to be the errorless typing of a line, paragraph, or page. Dickey in 1898 (Hart, 1971) expressed the beliefs of most typewriting teachers of the time when he said, "In the very start of typewriting we should aim at accuracy--speed will take care of itself" (p. 60). That phrase became very popular among teachers and was quoted extensively for years afterwards as the justification for the total-accuracy approach.

1920 - 1943

In this period of time, there were two developments in technology which affected the skill requirements of typists. The first occurred at the beginning of this period when the first modern electric typewriter was developed, making it possible to type faster because it was more versatile and easy to use. The second occurred near the end of this period when the ink eraser was developed and patented, making it possible to erase and correct some typographical errors, thus reducing the need to be totally accurate in initial keystroking. These two technological developments made it necessary for the typist to concentrate not only on accuracy but also on speed.

Throughout this period, teachers still felt that typists should primarily develop accuracy. However, for the first time, they also felt it was important to develop speed.

In the early 1920s, it was felt that speed development should begin only after the typist had learned the correct operation of the machine, the correct position, and be able to type accurately. Charles Smith (Hart, 1971) wrote in his Practical Course in Touch Typewriting in 1924:

> You should learn at the earliest possible moment that accuracy is the keynote of the preparation of all the great typewriting champions. It is the foundation-stone on which all high speed in typewriting rests. If you wish to become a high speed operator you must first lay this foundation-stone of accuracy--absolute, unfailing accuracy--accuracy that comes at your command and stays with you from start to finish. Such accuracy will give you a sense of power, a feeling of mastery, which will make your practice work a pleasure. To you, working under such an inspiration, the acquirement of speed will be an open secret (p. 18).

However, in 1931, Webb (Hart, 1971) wrote that emphasis should be given to speed as well as accuracy and that speed should grow naturally as the habits become stronger and more advanced.

Woodside in 1937 (Hart, 1971) believed that accuracy should not be the controlling factor in determining successful typewriting at every stage of development. He broadened the term accuracy to mean accuracy in production (doing real-life tasks) or accuracy in technique (eyes on copy, correct stroking, etc.) Among the first people to advocate less than perfect accuracy in keystroking was Pickel in 1940 (Hart, 1971) who said that accuracy in keystroking needed for real-life tasks was impossible to attain at the beginning of typewriting instruction until the student had become capable of using correct techniques. At this time, teachers increasingly felt that the greatest improvements in accuracy would come from the constant stressing of correct typing techniques. However, it was still believed that if there must be a choice between developing speed and developing accuracy, teachers should choose to develop accuracy at low levels of speed.

In 1942, Lessenberry (Hart, 1971) wrote that typewriting teachers agreed that speed of itself was of relatively little value. What was needed was to develop speed with control. Thus, typewriting teachers wanted their students to learn to type with speed, but they wanted speed with accuracy. It was felt that perfect accuracy keystroking was an unattainable and even undesirable goal, but development of accuracy keystroking had to take precedence over the development of speed keystroking.

1944 - Present

During this period, the Selectric typewriter was developed which used a ball instead of keylevers, thus allowing for faster typing. The ink eraser was readily available for typists' use, and later, several faster methods of error correction also came into general use. Thus, typists were required to type faster, with less emphasis on accuracy.

In 1944, Franklin (Hart, 1971) wrote that it was necessary to begin definite speed practice in the early stages of learning typewriting before techniques became established. He felt that it was easier to correct the errors of a fast writer than it was to speed up the rate of the slower one. In 1945, Du Frain (Robinson et al, 1979) wrote that it was practicable to emphasize speed before accuracy in beginning typewriting. This was a major change in the thinking of business educators because it was recognized that speed was much more important in early typewriting instruction than had previously been believed.

By 1955, it was felt that many teachers stressed accuracy too much at the beginning, and that accuracy and speed could not be attained separately but must be developed simultaneously. The student should no longer be criticized for the number of errors made on the first attempts. Instead, the teacher should urge the student to do better on the next attempt.

Thus, it was felt, increasingly more so as time passed, that accuracy was emphasized too much at the beginning of typewriting instruction. As Hart (1971) found, "The emphasis on accuracy at the outset of instruction is no longer considered a valid teaching method."

It was also stressed that speed had a place in early typewriting instruction. West (1969) said, "The proper emphasis during early training, both for keyboard learning and keystroking technique, is on stroking speed."

Today, it is generally believed that speed should be emphasized during the presentation of the typewriter keyboard when using a typewriter. Sherron (1984) wrote that research had proved that a speed approach was more desirable than an accuracy approach. During the presentation of the keyboard, the teacher should urge the student to type at a slightly uncomfortable rate, to constantly strive for speed but not go so fast that the student types gibberish (West, 1983). Not a lot of time is spent on practicing eliminating errors, unless those errors are excessive (McLean, 1984).

Summary of Teaching Strategies

In the period of time when the typewriter was harder to operate and there were little typographical error correction devices available, teachers required typewriting students to be very accurate. Speed was unimportant because it was hard to type fast on the early machines and also because the repercussions of even one typing error were too great.

When electrical typewriters and ink erasers were developed, documents could be produced more quickly since it was possible to type faster and also was no longer essential to type with complete accuracy. Therefore, teachers still wanted students to type accurately, but they also required them to type faster.

After Selectric typewriters and more efficient and faster ways of correcting typographical errors were developed, speed became more important and accuracy less important. Teachers, therefore, wanted students to type faster and to develop accuracy once a certain speed had been attained.

Typewriters are now being replaced by word processors in offices, and more slowly, in schools. Because there is such a difference between the technologies of the typewriter and the word processor, it is necessary to examine needed word processing skills in detail before appropriate strategies to teach them can be developed.

Word Processing Skills

The Changing of Skills with the Changing of Technologies

From the earliest typewriter to the latest word processor, the task of typewriting has remained essentially the same. West (1983) maintained that the basic concepts for keyboard learning, for building stroking skills, and for production typewriting apply equally to typewriters and to word processing devices. Thus, regardless of the machine, the student still has to learn the keyboard using the touch type method, still has to develop speed and accuracy in keystroking, and still must type real-life tasks without errors quickly.

However, although the tasks to be performed have remained fairly constant, how these tasks are performed and the specific skills necessary to accomplish them can vary according to the machine used. For example, only when using manual typewriters is there a need to type with brisk strokes to keep the characters of the typescript uniformly even. Only on manual or electric typewriters do operators have to be able to correct errors neatly and quickly by erasing or using liquid or tape correction materials (Ownby, 1982). Only when using a word processor is there a need to understand and use the concept of electronic memory of computers, such as storage and retrieval.

Not all the specific skills associated with a particular level of technology are transferred on to the next level. Throwing the carriage, for example, was needed only on manual typewriters; on electric typewriters and later on word processors, this was replaced by learning how to return the carriage or the cursor by pressing the Return key. Typing capital letters without raised characters was a skill needed on both manual and electric typewriters but not on word processors.

Thus, when a major change in technology occurs, it is important for educators to separate the old skills into those skills which are still needed and those which are obsolete. In addition, a careful assessment must be made of any new skills required by the new technology (Ownby, 1982). Then it is the task of teachers to teach only those skills needed by the new technology, and to develop appropriate replacement strategies.

Perceived Word Processing Skills

Since word processing is a new and changing form of typewriting, skills that are required by the word processor operator have not yet been fully determined. Little research has been conducted to date on word processing skills, and word processing operators and employers do not always agree on the necessary skills.

However, there are skills which are perceived in business and by business educators as being necessary for word processing.

Anderson, R.I., (1980) felt that high school students preparing for jobs in word processing should be taught:

1. Basic business language for word processing--emphasizing business English, spelling, proofreading, business writing, editing, and use of the dictionary.
2. Keyboarding skills--a minimum typing skill of 60 words per minute for five minutes with no more than five errors.
3. Machine transcription--minimum transcription rate of 25 words per minute.
4. Magnetic keyboarding--60 words per minute with no errors.

Further, she believed that practical work using a mini word processing center or laboratory would be beneficial.

In 1981, a national study of word processing installations was conducted by Delta Pi Epsilon, the graduate association of business teachers (Holley, 1982, and West, 1983). The data gathered concerned current practices in word processing installations in more than 300 organizations throughout the United States. One objective of this study was to determine what skills employers looked for in word processing operators. It was found that the desired skills fell into two areas: typewriting skills, which are the keystroking skills of speed and accuracy; and language skills, which include a good command of standard vocabulary, spelling, and punctuation. Accuracy and language skills were considered by these employers to be more important than speed.

Ettinger (1982) conducted a study in the New York Metropolitan area to identify competencies needed by word processing operators. The data were gathered from approximately 500 subjects in 73 companies which were representative of fields in which individuals would find employment in word processing. Competencies were divided into: Typewriting Skills, Office Equipment Skills, Office Skills, Written Communication Skills, Verbal Communication Skills, and Development of Attitudes. For correspondence secretarial positions in word processing, (where duties were typing and proofreading correspondence, reports and statistical information; transcribing from recorded dictation; and handling the telephone), the typewriting skills needed, in order of importance, were: accuracy in typing, operating magnetic media, speed in typing, text manipulation, erasing errors, and statistical typing. For administrative secretarial positions in word processing (where duties were the ability to handle the telephone; organize mail; book meeting rooms; operate copying equipment; handle special projects; proofread; and file and maintain records), the typewriting skills needed, in order of importance, were: accuracy in typing and erasing errors. The data of this survey supported the fact that both keyboarding and language skills were essential in carrying out the responsibilities of the secretarial job. However, it was believed that secretaries also needed skills in employee relationships, managerial techniques, and employee development that would enable them to move into managerial and supervisory positions not available previously to them.

Wagoner, K.P. (1982) said that to prepare students for word processing, business departments should stress English skills, teach keyboarding to all students, focus strongly on the relationship between data processing and word processing, prepare secretarial graduates for technology and for assuming responsibility in assisting management, and maintain close contact with business.

Merrier (1983) sent a questionnaire to nearly 500 members of two word processing professional associations in Wisconsin and Minnesota, focusing on pre-employment testing in word processing. One of its objectives was to determine the relative importance that word processing operators placed on seven criteria as prerequisites for employment in word processing. Keyboarding/typewriting ability and grammar proficiency were identified by the respondents as being the criteria most important to on-the-job success in word processing. The other criteria were proofreading, word processing concepts, machine transcription, ability to use reference materials, and mathematics.

Robertson and West (1984) conducted a survey of companies in the area of Chattanooga, Tenn., that used word processing. Its primary purpose was to gain data to enable curricula planners to plan an effective word processing curriculum. One of its secondary objectives was to determine basic attitudes/skills needed by word processing operators. It was found that typewriting was the single most important factor of word processing success. Next in importance were the ability to cope with working in a "machine-oriented atmosphere" in relative isolation from other employees, experience working with rough-draft copy, and machine transcription.

Curley (1986) felt that the two most important criteria for word processing pre-requisites were keyboarding skills and computer literacy skills.

In summary, it was generally agreed that language skills including business English (grammar), vocabulary, spelling, and proofreading were necessary for word processing. It was also generally agreed that the skill of keyboarding was necessary, but it was not determined whether speed or accuracy was more important for word processing. Some people felt that word processing concepts were important, and only a few stated that machine or computer literacy skills were needed. In addition, some skills were listed by individual researchers which were not generally substantiated by the others.

Thus, it can be seen that although there is some agreement on the skills necessary for word processing, there are also considerable differences of opinion.

Summary

Throughout the history of the processing of information, people have responded with technology whenever a change in the method of processing has been needed.

First, the typewriter was invented to help process words faster, more neatly and more uniformly. Together with the typewriter, methods of correcting typographical errors were developed. For each level of technology, typists required certain specific skills in order to operate the machines as efficiently as possible.

Educators developed methodologies and strategies to teach the required skills, which were heavily influenced by the available typewriter and error correction technology. Throughout the years, a considerable body of research helped business teachers determine effective ways of teaching typewriting on the typewriter.

In business, the typewriter is rapidly giving way to the word processor. This major change in technology is bringing with it changes in error correction and subsequently possible changes in the skills necessary for the operators. This, in turn, implies probable changes in the methodologies for teaching the optimal use of the technology.

Because word processing technology is still relatively new and constantly changing, business and business educators do not always agree on the word processing skills needed today. In addition, little research has been conducted on instructional methodologies for word processing skills (West, 1983). Therefore, there is a need to determine exactly what skills are required to effectively and efficiently produce documents on a word processor.

It is generally agreed that the skill of keystroking is a necessary skill for word processing as it was in typewriting. However, there is as yet no agreement on whether it is speed keystroking or accuracy keystroking which is more important in word processing. In the past, it was seen that the necessary skills of speed and accuracy keystroking changed directly with the technology. For these reasons, it was decided to determine if the relative importance of the skills of speed keystroking and accuracy keystroking have been changed by the new word processing technology.

In addition, because word processing involves the use of computers, which is a new element in typewriting, and also because there is indecision on the importance of computer skills for word processing operators, it was decided to investigate whether computer skills are necessary requirements for word processor operators.

Finally, because most people seem to have an opinion on the new electronic technology, it was decided to determine if attitudes towards the new technology have any effect on production work.

Therefore, this study was designed to determine the effects of the keystroking skills of speed and accuracy, computer skills, and attitudes to computers and word processors on the proficiency of typing production work on a word processor.

CHAPTER III

THE INVESTIGATION

Introduction

This chapter begins with a description of the objectives and the research questions of the experiment. Then the measures that were used and the pilot tests that were done are enumerated and the sample described. Next, the administration of the experiment and subjective observations are detailed and scoring of the instruments described. Finally, the statistical techniques used for the data analysis are listed.

Objectives

In order to determine some factors affecting word processing production performance, an experiment was designed which had three main objectives.

The first objective was to investigate the keystroking skills of speed and accuracy on word processing production work to determine if the different technology of the word processor, with its easy error detection and correction facilities, required a different emphasis on speed and accuracy keystroking than that which had developed in conjunction with the evolution of the typewriter.

The second objective was to determine the effects of computer skills on word processing production work. This objective consisted of two parts. The first was to determine if potential computer skills, specifically, programming aptitude, has an effect on word processing production work. The second was to examine the effects of computer literacy knowledge to determine if computer knowledge has an effect on word processing production work.

The third objective was to examine students' attitudes towards the new technology. Since computers are still comparatively new to students and, therefore, in some cases somewhat threatening, attitudes towards the new technology may be related to production proficiency. Noll, Scannell, and Craig in 1979 are quoted by Nyberg and Clarke (1981) on attitudes:

> They are closely associated with feelings and emotions and are a large factor in determining our reactions and behaviour. An attitude may be thought of as a response pattern or a tendency to think or act in a particular way under a given set of circumstances (p. 1).

Research Questions

In order to test these objectives, the following research questions were posed:

1. Is there a relationship between speed keystroking skills and speed skills in word processing production work?
2. Is there a relationship between accuracy keystroking skills and accuracy skills in word processing production work?
3. Is there a relationship between aptitude for programming and
   a) speed skills in word processing production work?
   b) accuracy skills in word processing production work?

4. Is there a relationship between computer literacy knowledge and
   a) speed skills in word processing production work?
   b) accuracy skills in word processing production work?
5. Is there a relationship between attitude to computers and
   a) speed skills in word processing production work?
   b) accuracy skills in word processing production work?
6. Is there a relationship between attitude to word processing and
   a) speed skills in word processing production work?
   b) accuracy skills in word processing production work?

An experiment was designed in order to investigate these research questions.

The Measures

For all the above research questions, it was necessary to obtain a measure of both speed and accuracy skills in word processing work. In addition, each research question required further measures: for the first two questions, speed and accuracy keystroking skills in straight-copy timings; for the third question, aptitude for programming; for the fourth question, computer literacy knowledge; and for the last two questions, attitudes to computers and word processing.

Speed and Accuracy Skills in Word Processing Production Work

For all the research questions, it was necessary to measure the skills of speed and accuracy in the production of documents which may require formatting, proofreading, and editing in addition to typing.

Manuscripts were chosen for the production work because they require paragraph typing and also because they have been used in traditional typewriting situations. The first manuscript contained ordinary words which the student may have typed before; the second manuscript contained technical terms with which the student was probably unfamiliar, in addition to some special keyboard characters such as quotation marks and brackets; the third manuscript contained ordinary words but required more manipulation of the word processor, such as left and right indent, right justification, and superscripts.

To provide valid and reliable measures of the stroking skills applicable to the vocabulary of written business communication, the manuscripts were all written at a syllabic intensity of 1.65 for each paragraph (Robinson, 1967). This is the level of syllabic intensity used in business (Ober, 1983). They were prepared by the investigator because manuscripts of the necessary vocabulary, length and syllabic intensity could not be found. These manuscripts appear in Appendix A.

Speed and Accuracy Keystroking Skills for Straight-Copy Timings

In addition to determining the speed and accuracy skills of students when typing production work, it was also necessary for the first two research questions to determine speed and accuracy keystroking skills; that is, the number of keystrokes with and without errors when no formatting decisions, proofreading, or editing were required or allowed. To achieve this, straight-copy timings were used where the student could type line for line from a copy without stopping to proofread or correct errors.

Four timings and two computer programs were designed and developed for this purpose.

<u>The Timings</u>: Four straight-copy timings listed in Appendix A were written by the investigator for the students to type from during the timing. Because the students made an exact copy of the timing, no formatting decisions were required during the typing. The following criteria were considered in their design:

1. <u>Length of Timing</u>: Because variations in timing duration can cause differences in speed and accuracy levels, it was decided to use the same time duration for each timing to ensure reliability. That time duration was chosen to be five minutes for two reasons. First, five minutes is the common length of time used for a timing in advanced typewriting classes and also in business for employment testing. Second, this time length is necessary to get a reasonably reliable measure of accuracy (West, 1983). Enough material was included in each timing so that a student could type up to 75 words per minute without repeating any text.
2. <u>Timing Difficulty</u>: All the timings had a syllabic intensity of 1.65 for each paragraph. This was done to make them comparable to the manuscripts and to business vocabulary.

<u>Computer Timing Program</u>: An instrument was needed on a microcomputer to measure initial keystrokes while ensuring that no correction of errors or editing occurred. Because no suitable programs were avail-

able, a computer program for a microcomputer was written by the investigator. It timed the student accurately for a specific number of minutes while the student typed from the Timing copy. If an attempt was made at correcting an error by backspacing and typing the correct stroke, a strikeover was recorded in computer memory. This ensured that all keystrokes were measured. At the end of the timing, the student's initials and timing number, the number of minutes of the timing, the student's gross words per minute (which was calculated) and the timing itself were saved on the diskette.

Computer Utility Program: A utility program was also written by the author for her use. Its purpose was to make hard copies of the students' timings so that they could be proofread for accuracy.

Computer Aptitude, Literacy & Interest Profile

To measure potential computer abilities, specifically aptitude for programming, the standardized test, Computer Aptitude, Literacy, and Interest Profile (CALIP) was used (Poplin, Drew and Gable, 1984). It was developed to assist vocational counselors and personnel managers in guiding junior and senior high school students and adults in making career decisions related to computers.

The main focus of this test is to identify persons with high potential for programming. This focus was chosen because the job of programmer was the best defined and most popular technical occupation of the computer-related professions. Since the objective of the test is to measure aptitude apart from previous experience and complex verbal skills such as reading comprehension, the four aptitude subtests of CALIP were esigned with a minimum of reading comprehension requirements and without reference to specific computer knowledge.

Subtest 1, Estimation, has 24 blocks containing various numbers of small squares, some of which are darkened. The task is to estimate the number of darkened squares in all 24 blocks in two minutes. This severe time limitation forces the student to choose a strategy of estimation if all items are to be completed.

Subtest 2, Graphic Patterns, has 20 language-free items. Each item represents a set of figures in which some or part of the figure is missing. The student is expected to select the correct figure from among four or six alternatives. Correct alternatives are based on implicit rules of patterning, such as matching or addition or subtraction of elements.

Subtest 3, Logical Structures, has 20 items, each of which contains numbers, letters, or words typically with an implicit logical pattern. The student chooses the correct answer from four alternatives.

Subtest 4, Series, consists of 24 items, where each item requires the student to complete a number and/or letter sequence by choosing an answer from among four alternatives.

These subtests and their items were chosen by the authors of CALIP because a literature review conducted by them showed that the aptitudes most mentioned as being related to computer programming abilities were: quantitative (subtest 1); logical (subtest 2); spatial (subtest 3); and sequential (subtest 4).

The sum of these four subtests was the student's programming aptitude score which was used to measure an individual's computer abilities. This was found to have adequate validity and reliability (coefficients of approximately .80 or higher) at all age levels.

Computer Literacy Questionnaire

To determine if knowledge of computer literacy has any effect on word processing performance, a questionnaire was written by the author to measure the extent of computer literacy knowledge. It is listed in Appendix B.

It was decided to follow the instructional objectives for computer literacy developed in the late 1970s and early 1980s by MECC, the Minnesota Educational Computing Consortium (Anderson, R.E., 1982, and Randhawa and Hunt, 1984), because these are the most comprehensive categorization of computer literacy that was found in the literature. The MECC instructional objectives were categorized into eight areas or domains (Anderson and Klassen, 1981, and Pawloff, 1981):

1. Applications: This area covers the multitude of social and organizational areas into which computers have been integrated. It also covers the general considerations for applying computers to new situations.
2. Hardware: This domain is concerned with the basic vocabulary of computer system components.
3. Impact: This area encompasses the social effects of computerization, including both the positive and negative impacts of computers on society.

4. Limitations: This area focuses on developing a general sense of the capabilities and limitations of computing machines.
5. Programming/Algorithms: This domain is the ability to read, modify, and construct algorithms and programs.
6. Software and Information Processing: This area includes vocabulary relevant to software, information processing, and data.
7. Usage: This domain involves motor skills for sequencing and execution of certain tasks on the computer or computer terminal.
8. Values and Feelings: This area centers on developing a positive attitude toward personal use of computers as well as a balanced attitude towards computers as a social force.

Each of these instructional objectives was divided into elementary and advanced behavioral outcomes.

In constructing the test required for this study, there were two reasons for modifying these instructional objectives and behavioral outcomes. First, the objectives were developed approximately five years ago when computer literacy in schools was a relatively new concept. Second, they were developed in the United States. Thus, some changes were needed to bring the objectives and behavioral outcomes of computer literacy up to date and to localize them for this geographical area.

It was also decided to use all MECC's instructional objectives except Values and Feelings. This latter objective was omitted because it was to be tested separately under Attitudes. In addition, a number of questions on the history of computing were added because it was felt that knowledge in this area would indicate a deeper understanding of computer literacy.

Before deciding to develop the test instrument, all questionnaires found in the literature were examined but found to be unsuitable. CALIP's computer literacy sub-test was deemed unacceptable because it covered only three of MECC's objectives; in addition, its authors recommended that it not be given to young people or others who have had limited exposure to the "computer world," due to its high correlation to computer-related experience.

Another test on computer literacy (Billings and Moursund, 1981) was not sufficiently comprehensive, with questions often worded ambiguously. MECC's own User Guide (Anderson, Krohn, & Sandman, 1980) could not be used because many of the questions were out of date, unsuitable for Alberta high school students, or contained questionable wording.

Therefore, a computer literacy questionnaire was written specifically for high school students in Calgary in 1986. It consisted mainly of multiple choice items with some true/false questions as suggested by Gronlund, 1982.

The first main section of the questionnaire encompassed History, Hardware, Software and Information Processing, Applications, Impact, and Limitations. For this section, it was decided to use only the elementary objectives because they were the "core" or basic objectives of computer literacy. More questions were given on Hardware than any other objective because there were more elementary behavioral outcomes given for Hardware than any other objective. An equal number of questions, about half the number for Hardware, were asked for each of Software and Information Processing, Applications, and Impact because it was desired to attach equal importance to them and because they had approximately half the number of elementary behavioral outcomes as Hardware. The smallest number of questions were related to History and Limitations, both because it was desired to attach less importance to them and because Limitations had the fewest number of elementary behavioral outcomes and History had none. Detailed information on Instructional Objectives and Behavioral Outcomes for the Computer Literacy Questionnaire, Knowledge of Computers, are listed in Appendix B.

The second main section of the questionnaire encompassed Usage and Programming/Algorithms. For this section, it was decided to use both elementary and advanced behavioral outcomes because programming has been greatly emphasized in both junior and senior high schools in Calgary. The Usage section contained approximately the same number of questions as History and Limitations because of its considered importance, and also because it had approximately the same number of behavioral outcomes as Limitations. A large amount of questions were concerned with Programming/ Algorithms due to its past importance in schools. Questions about programming were asked using the programming language BASIC, again because this was the main language studied in junior and senior high schools. Some behavioral outcomes were changed to adapt them more closely to the BASIC programming language, and to fit them more closely to the material covered in the local schools. Appendix B gives the Instructional Objectives and Behavioral Outcomes for the Computer Literacy Questionnaire, Knowledge of BASIC Programming.

After the Computer Literacy Questionnaire was written, it was checked for face validity by a panel of experts most of whom have been teaching computing for many years in the local school systems. As a result of their comments, changes were made in numerous questions, particularly in their wording.

School Subjects Attitude Scale

To determine if attitude to computers or word processing had any effect on word processing performance, the School Subjects Attitude Scale (SSAS) from Alberta Education (Nyberg and Clarke, 1983) was used.

This scale was developed in 1978 and 1979 at the University of Alberta to measure students' attitudes toward school subjects from grades 5 to 12. It was desired that the scales should:

1. Be readily understood by users (teachers and students);
2. Insofar as possible, not be subject to faking;
3. Yield more than one score;
4. Produce valid and reliable results;
5. Be short enough so that several school subjects could be rated in a normal class period;
6. Be suitable for all school subjects at widely different grade levels;
7. Have the capability for hand scoring in addition to machine scoring.

In order to accomplish these seven points, the Semantic Differential technique was adopted (Osgood, Suci, and Tannenbaum, 1957). This technique was devised for the measurement of the meaning of concepts. The meaning associated with a given concept is determined through responses on a five or seven point rating scale between several sets of bipolar adjectives. When the Semantic Differential technique is used, three factors are commonly found: evaluative, which includes pairs such as good-bad or nice-awful; potency, with pairs such as strong-weak or light-heavy; and activity, containing adjective pairs such as fast-slow or dull-exciting.

The technique was adapted to suit the task of developing the School Subjects Attitude Scale. A list of more than 100 bipolar adjectives was first assembled from various sources. Through discussions with teachers and students, and through analysis of trial forms, 24 word pairs were selected. Three factors emerged which were somewhat similar to the three normally found: an evaluative factor, which was similar to Osgood's evaluative factor but also included the activity factor; a usefulness factor which was similar to the potency factor; and a difficulty factor, which was essentially unique to this scale containing word pairs such as hard-easy and clear-confusing and which was necessary in measuring attitudes of students toward a school subject.

The 24 word pairs were divided into eight defining the evaluative factor, eight defining the usefulness factor, and eight defining the difficulty factor. The positive answers of each word pair were not always on either one side or the other, but appeared an equal number of times on the left and right sides. Between each word pair, there were five response positions (circles) with verbal guideposts so that the student understood clearly the exact meaning of each response position. Thus, the school subject to be judged was rated by placing one mark between each adjective pair. In this way, the student expressed an opinion on the subject.

In scoring this instrument, each response has a value ranging from 1, the most negative feeling, to 5, the most positive feeling. Because there were eight word pairs in each group, 8 represented the most negative score of a group; 24 an entirely neutral score; and 40 the most positive score.

SSAS was found to be very reliable for higher grades. It was found to be valid on four different comparisons: expert opinion, student preferences, sex differences, and cultural differences.

The scales of the evaluative factor were used to determine students' attitudes in this research.

Pilot Tests

Before the main experiment was conducted, a number of pilot tests were carried out to test and refine some of the measuring instruments.

Timing Program: The program to determine students' speed keystroking skills was administered to a group of typewriting teachers at a workshop given by the investigator. As a result of their comments, small changes were made in the instructions to the user within the program.

CALIP: In an attempt to eradicate any problems in the administration of this test, it was given to 20 students in a Computer Processing 10 class in a Calgary high school. As a result of this trial run, some minor changes were made in the planned administration of the instrument.

Computer Literacy Questionnaire: To further test this instrument, it was administered to 60 students in the Computer Processing 10 classes in another Calgary high school. Upon completion, an item analysis was conducted which resulted in further changes in various questions.

To test the questionnaire after the above changes were made, it was given to 20 students in a Computer Processing 10 class in a different Calgary high school. An item analysis was again conducted and final changes made.

The Sample

This experiment was conducted in all the high schools of the Calgary Board of Education where students were using the word processing software package WordPerfect on the Olivetti M-24 microcomputer in an advanced typewriting class. This resulted in three schools with student populations between 1450 and 1700 taking part in the experiment, and the sample consisted of the entire student group which met the above criteria in each school.

Complete data were collected on 31 students altogether; 11 in one school, 12 in another, and 8 in the third. The classes were fairly small because both the word processor and the microcomputer were new to the school system, and it was the first time either were used in such a class. All the students in all three schools received the same treatment.

The length of the classes in two schools was approximately 65 minutes. In the third school, classes were 78 minutes.

The students in the classes were all girls, ranging in ages from 16 to 19, with most students (68%) being 17 years of age. All the students were in grade 12 and had been using WordPerfect on the Olivetti M-24 microcomputer for approximately three months.

Administration of the Experiment

All test materials were administered by the investigator and her assistant, a graduate student in the Computer Applications Unit at the University of Calgary, during the latter part of April and the first half of May, 1986. Testing in each school took place during five consecutive days. Students were not told before the experiment that they were participating in a controlled study. However, on the first day, the investigator explained the study to them and requested their cooperation.

A folder was prepared for each day with all the materials needed by a student for the current day included.

Test Day 1

Each student was given a folder which contained the CALIP Test Booklet, the CALIP Answer Booklet, and a piece of blank scrap paper in case it was needed. In addition, a pencil was provided.

Each student wrote her name on the label of the folder, and for the remaining four days, used that particular folder.

The students first did Subtest 1, which was timed for two minutes. Then they had approximately 50 minutes to complete subtests 2 to 4.

When the student had finished, she placed the sheet of paper, the CALIP Test Booklet and the CALIP Answer Booklet into the folder, and handed it and the pencil to the investigator or the assistant.

Appendix C contains the CALIP Oral Instructions given by the investigator to the students.

Test Day 2

Prior to going to the school, the investigator removed Day 1 materials and inserted the following into each folder: two Alberta School Subjects Attitude Scales; a Student Questionnaire on Computer Literacy; Instructions for Straight-Copy Timings; Timing Practice; and one piece of blank scrap paper. In addition, a diskette called "Timing Diskette" which contained the programs for the straight-copy timing was inserted into an envelope taped on the inside left side of the folder.

Each student picked up her folder and a pencil. The investigator told the students that they were to participate in three different assignments that day: first, to complete scales to measure their attitudes toward computers and word processors; second, to complete a computer literacy questionnaire; and third, to type a five-minute timing.

Attitudes: The students were asked to take out the Alberta School Subjects Attitude Scale, Subject Computers, from their folder and fill in the required personal data. It was then explained to the student how to complete it. The student was also urged to be honest and to rate each adjective pair according to what she really felt, not what she thought she ought to answer. The students were told that their teacher would not give them a mark based on their answers.

When the students had completed the SSAS on Computers, they were asked to complete another SSAS on Word Processing.

Upon completion of the two scales, the students returned them to their folders.

Computer Literacy Questionnaire: The students were asked to complete a Student Questionnaire on Computer Literacy. First, they were asked to complete Section A, Background Information, which included their name, age, grade and information on their past computer-related experiences. When they were ready to begin, they were encouraged to answer every question as there was no penalty for incorrect answers. The students were given 30 minutes to complete the questionnaire.

When all the students had finished the questionnaire, each student returned her questionnaire to the folder.

Timing: The students were told that they were going to do a timing for practice, to become familiar with the program, the timing, and how it was to be administered. It was stressed that this timing was just for practice and was not to be included in the experiment. It was felt that it was necessary to give the students a practice timing first, to familiarize them with the procedure. The students were asked to take out the Instructions for Straight-Copy Timings, detailed in Appendix C, from their folders and read them. Then they were asked to load the timing program and complete a five-minute timing by following both the instructions in the handout and those in the program, also detailed in Appendix C. Some of the details in the handout were repeated in the program as a last-minute reminder to the students.

When the student had finished her timing, she put the diskette back in its envelope and the Timing Practice and Instructions for Straight-

Copy Timings handouts back in the folder, and handed it and the pencil to the investigator or the assistant.

The investigator later printed a copy of each timing and circled each error and then put these marked copies back in the folders for each student to view on the following day.

Test Days 3, 4, and 5

On each of these three days, the student completed a five-minute straight-copy timing and a manuscript production job.

Prior to going to the school, the investigator removed the previous day's materials and inserted the following into each folder: Instructions for Straight-Copy Timings; Timing #1 (Day 3), Timing #2 (Day 4) or Timing #3 (Day 5); Student Instructions for Typing the Manuscript; and a sheet of blank scrap paper. In addition, the Timing Diskette was inserted into the envelope taped on the inside left side of the folder; and a diskette called "WordPerfect Data Diskette" was inserted into an envelope taped on the inside right side of the folder. This Data Diskette was to be used by the student for saving the word processing manuscripts.

Each student picked up her folder and a pencil. The investigator told the students that they were to type a five-minute timing and then prepare a manuscript on the word processor.

Timing: The investigator asked each student to take the Timing Diskette, the Instructions for Straight-Copy Timings, and the Timing Handout (Timing #1 or #2 or #3) for that day out of the folder. The students were asked to read the instructions for Straight-Copy Timings, load the program, and type a five-minute timing. Both the investigator and the assistant were available if a student required assistance.

To increase reliability and validity of straight-copy performance, the students received the same instructions for each timing; and the timings were administered at the same time each day, at the beginning of the period, to minimize the possible effects that any typing done before the timing could have on straight-copy performance (West, 1983).

When finished, the student returned the Timing Diskette and the two handouts back to the folder.

Manuscript: The investigator was not required to provide WordPerfect templates, program diskettes or speller diskettes for the students because the teacher in each school had a sufficient number of each for the students' use. When the students were ready to begin their production work, the investigator asked the students to take the Student Instructions for Typing the Manuscripts, detailed in Appendix C, out of their folders and read it from beginning to end. They were then asked to complete the first four items in the handout.

When a student was ready to start the manuscript, she put up her hand. The investigator or her assistant wrote down the time, to the nearest one-quarter minute, under a heading called Time Began on a Manuscript Times sheet, detailed in Appendix C, and handed it and a copy of the manuscript for that day (Manuscript #1 for Day 3, Manuscript #2 for Day 4, or Manuscript #3 for Day 5) to the student. She then wrote down her name, the date and the manuscript number on the Manuscript Times sheet.

When the student finished the task, she put all the materials back in the folder and handed it in. The investigator or the assistant immediately wrote down the time, to the nearest one-quarter minute, under a heading called Time Ended on the Manuscript Times sheet. The investigator later calculated the difference between the two times and wrote it down under a heading called Total Time on the Manuscript Times sheet.

Thus, each student's time score, which was the time needed to complete a specified body of work, was determined for each manuscript. West (1983) suggested that time scores for production work should be used as the measure of production speed because it was more reliable than work scores in which the time was constant and the amount of work varied.

Subjective Observations

In all three schools, the experiment was conducted as planned and no problems arose in the collection of the required data.

Classroom Teachers: The teachers who allowed the investigator to conduct the experiment with their classes were very helpful and cooperative and had very positive attitudes both to the experiment and to the new technology which they were using for the first time. These positive feelings transferred to their students.

Students' Attitudes to the Experiment: The students in all three schools were very interested in the experiment, and in the fact that they were the ones chosen to participate. They tried to cooperate fully with the investigator and the assistant, and often asked questions about the experiment. They appeared to enjoy the break from the usual school routine.

The positive attitudes displayed led the investigator to believe that they were doing their best and answered all questions as accurately as possible. Comments in the nature of "How did I do on my manuscript? How fast did I type? I don't think I made too many errors" showed that they were interested and concerned about their results and wanted to do well.

The investigator thus felt that any errors made were for reasons other than negative attitudes towards school or disinterest in the assignments of the experiment, and that the data collected was as accurate as could be obtained in the given experimental situations.

Scoring of Test Instruments

Manuscripts and Timings: All these documents except the Practice Timing were scored separately by the investigator and her assistant. Then they reviewed each document together. This was done to ensure accuracy of scoring on these difficult-to-mark test materials.

A handout called Determining Errors listed in Appendix D was prepared by the investigator giving the specific details of how both typographical and other errors should be determined. In preparing this handout, the investigator used two sources: her 13-year experience in teaching typewriting and word processing; and the Scoring Manual prepared by Johnson, I.W. (1981) to determine typewriting errors for both straight-copy timings and production work.

Word processing speed skill was measured as the time taken to complete the manuscript to the nearest one-quarter minute. The gross words per minute for each student for each manuscript was then calculated.

Word processing accuracy skill was determined as the number of typographical errors and the number of other errors. Typographical and other errors were then added together to get total errors for each manuscript.

Straight-copy speed keystroking skill was calculated by the computer by dividing the total keystrokes by five to determine total words, and then by dividing the total words by five to give gwpm. Straight-copy accuracy performance was determined as the number of typographical errors for each timing.

CALIP and Computer Literacy: The results from these instruments consisted entirely of right-or-wrong responses. Because they were very straight-forward, only the investigator marked them. However, all answers were double checked to ensure accuracy.

SSAS: The two School Subjects Attitude Scales were machine scored. A mark was calculated for each student for each of the three factors.

Statistical Techniques

In order to test for relationships between variables, correlations were computed for all the variables for each manuscript using a computer program written by Prof. A. Brebner of the University of Calgary.

For this research, it was decided to use a significance level of 0.05. The critical value of the correlation coefficient for a sample size of 31 at this level of significance for a two-tailed test with 29 degrees of freedom is .355 (Ferguson, 1971, p. 457).

In addition, means were calculated for timing errors, manuscript typographical errors, manuscript other errors, and manuscript total errors.

CHAPTER IV

RESULTS

Introduction

In this chapter, the findings of the experiment are examined statistically for each manuscript in relation to the stated research questions. This is followed by results supplementary to those of the main research questions.

Results Relating to Research Questions

For each manuscript, the specific measures relating to the research questions were compared with the speed and accuracy scores in a real-life production job on a word processor. Correlation matrices were calculated to determine the relationships between the different measures of the experiment.

Thus, the keystroking scores measuring speed and accuracy obtained from the timings were correlated with word processing speed and accuracy scores obtained from the manuscripts for the first and second questions respectively. For the third and fourth questions, aptitude for programming and computer literacy were correlated with both word processing speed and accuracy. Finally, for the fifth and sixth questions, attitudes to computers and word processing were correlated with both word processing speed and accuracy scores.

Manuscript 1

The word processing speed and accuracy scores of Manuscript 1 were correlated with the speed and accuracy keystroking scores of Timing 1, programming aptitude scores, computer literacy scores, and scores measuring attitudes to computers and word processing.

Research Question 1: Correlating speed in keystroking and word processing speed, a correlation coefficient (r) of .521 was obtained. This indicated that the faster or slower students could type, the faster or slower they typed their manuscript.

Research Question 2: There was no significant correlation between the scores measuring accuracy in keystroking and word processing accuracy.

Research Question 3: No significant relationship was found between aptitude for programming and word processing speed or accuracy.

Research Question 4: Significance was not obtained between computer literacy scores and word processing speed. However, correlation coefficients of -.342 and -.337 were obtained in correlating computer literacy scores with word processing accuracy, specifically, total errors and typographical errors, respectively. These figures were not quite significant, but they do indicate a trend that for greater computer literacy knowledge, typographical errors on the manuscript are lower; or for little computer literacy knowledge, typographical errors are higher.

Research Question 5: No significant relationship was obtained between attitude to computers and word processing speed or accuracy.

Research Question 6: There was no significant relationship found between attitude to word processing and word processing speed or accuracy.

Manuscript 1 Summary

A strong relationship was found between word processing speed skills and speed keystroking skills. In addition, there was a trend for the number of word processing typographical errors to decrease as knowledge of computer literacy increased.

The correlation coefficients for Manuscript 1 are shown in Table 1.

Manuscript 2

The word processing speed and accuracy scores of Manuscript 2 were correlated with the speed and accuracy keystroking scores of Timing 2, programming aptitude scores, computer literacy scores, and scores indicating attitudes to computers and word processing.

Research Question 1: Correlating speed in keystroking with word processing speed, a r of .492 was obtained. This indicates that a relationship was found between speed keystroking skills and manuscript speed: as one increased or decreased, so did the other.

Research Question 2: Correlating accuracy in keystroking with word processing accuracy, a r of .390 was obtained for typographical errors. This shows that there was a positive relationship between accuracy in keystroking and manuscript typographical errors: as keystroking accuracy increased or decreased, so also did manuscript typographical errors.

Research Question 3: Correlating aptitude for programming with word processing speed, a r of .392 was calculated, indicating that there was a positive relationship between students' potential programming ability and manuscript speed.

TABLE 1

RESULTS RELATING TO RESEARCH QUESTIONS

CORRELATION MATRIX FOR MANUSCRIPT 1

	GWPM	Typo Errors	Other Errors	Total Errors
Timing #1 GWPM	**.521** [1]			
Timing #1 Errors		.178 [2]	-.015 [2]	.063 [2]
Programming Aptitude	.130 [3a]	-.024 [3b]	-.164 [3b]	-.144 [3b]
Computer Literacy	-.299 [4a]	(-.337) [4b]	-.246 [4b]	(-.342) [4b]
Attitude to Computers	.145 [5a]	.091 [5b]	.190 [5b]	.193 [5b]
Attitude to Word Processing	.076 [6a]	-.011 [6b]	-.005 [6b]	-.009 [6b]

Significant correlations are shown in bold type, and trends are in brackets.

For each correlation the research question number is given.

However, no significance was obtained in correlating aptitude for programming with word processing accuracy.

Research Question 4: Correlating computer literacy scores with word processing speed, a r of -.356 was determined. This shows that there was a negative relationship between computer literacy and word processing speed.

Correlation coefficients of -.515 (total errors), -.401 (typographical errors), and -.366 (other errors) were obtained from correlating computer literacy scores with word processing accuracy. This indicates that as students' knowledge of computer literacy increased, both typographical and other manuscript errors decreased; and vice versa.

Research Question 5: Significance was not obtained between attitude to computers and word processing speed or accuracy.

Research Question 6: Correlating attitude to word processing with word processing speed, a r of .352 was obtained. Although not quite reaching significance, this shows a trend that as attitude to word processing was more positive, manuscript speed increased; when attitude was more negative, manuscript speed decreased.

However, no significance or trend was evident between attitude to word processing and word processing accuracy.

Manuscript 2 Summary

Significant relationships were found between word processing speed and speed in keystroking, word processing speed and aptitude for programming, and word processing speed and computer literacy.

Significant relationships were also found between word processing typographical accuracy and accuracy in keystroking, and word processing accuracy (all measures) and computer literacy knowledge.

In addition, a positive trend was found between word processing speed and attitude to word processing.

The correlation coefficients for Manuscript 2 are listed in Table 2.

Manuscript 3

The word processing speed and accuracy scores obtained from Manuscript 3 were correlated with the speed and accuracy keystroking scores of Timing 3, programming aptitude scores, computer literacy scores, and scores for attitudes to computers and word processing.

Research Question 1: A correlation coefficient of .532 was obtained in correlating speed in keystroking with word processing speed. This indicates a strong positive relationship between speed keystroking skills and manuscript speed: as keystroking speed increased or decreased, manuscript speed also increased or decreased.

Research Question 2: Correlating accuracy in keystroking and word processing accuracy, correlation coefficients of .387 (total errors), .374 (typographical errors), and .328 (other errors) were determined. This shows positive relationships between typographical errors and accuracy in keystroking, and between total errors and accuracy in keystroking. Thus, as students made fewer (or more) errors when keystroking, they also made fewer (or more) typographical and total errors in their manuscript; and there was a trend also to make fewer (or more) other errors.

TABLE 2

RESULTS RELATING TO RESEARCH QUESTIONS

CORRELATION MATRIX FOR MANUSCRIPT 2

	GWPM	Typo Errors	Other Errors	Total Errors
Timing #2 GWPM	**.492** [1]			
Timing #2 Errors		**.390** [2]	.078 [2]	**(.304)** [2]
Programming Aptitude	**.392** [3a]	.101 [3b]	-.298 [3b]	-.179 [3b]
Computer Literacy	**-.356** [4a]	**-.401** [4b]	**-.366** [4b]	**-.515** [4b]
Attitude to Computers	.100 [5a]	.298 [5b]	.074 [5b]	.242 [5b]
Attitude to Word Processing	**(.352)** [6a]	-.113 [6b]	-.194 [6b]	-.209 [6b]

Significant correlations are shown in bold type, and trends are in brackets.

For each correlation the research question number is given.

Research Question 3: No relationships were found between aptitude for programming and word processing speed or accuracy.

Research Question 4: No relationship was found between computer literacy and word processing speed.

However, correlation coefficients of -.483 (total errors), -.337 (typographical errors), and -.493 (other errors) were obtained in correlating computer literacy with word processing accuracy. This indicates that as the level of knowledge of computer literacy increased or decreased, other and total errors on the manuscript decreased or increased respectively; and there was a trend for typographical errors also to decrease or increase in the same manner.

Research Question 5: There was no significant relationship between attitude to computers and word processing speed.

However, correlation coefficients of .372 (total errors) and .423 (typographical errors) were obtained in correlating attitude to computers with word processing accuracy, indicating that a positive relationship existed between attitude to computers and the number of typographical and total errors in the manuscript.

Research Question 6: Correlating attitude to word processing with word processing speed, a r of .492 was determined. Therefore, when attitude to word processing was more positive, manuscript speed was higher; when it was less positive, the speed was lower.

No relationship was found between attitude to word processing and word processing accuracy.

Manuscript 3 Summary

Significant relationships were found between word processing speed and speed in keystroking, and word processing speed and attitude to word processing.

Significant relationships were also found between word processing accuracy (typographical and other errors) and accuracy in keystroking, word processing accuracy (other and total errors) and computer literacy, and word processing accuracy (typographical and other errors) and attitude to computers.

In addition, trends were found between word processing accuracy (other errors) and accuracy in keystroking; and between word processing accuracy (typographical errors) and computer literacy.

The correlation matrix for Manuscript 3 is shown in Table 3.

Supplementary Results

When the correlations were determined, there were a number of significant correlation coefficients obtained which did not directly relate to the research questions. In particular, the following relationships were found between:

Programming Aptitude and Speed in Keystroking: Correlation coefficients of .362, .429 and .412 for Timings 1, 2, and 3, respectively, and programming aptitude were obtained. This indicates a positive relationship between programming aptitude and speed in keystroking: as aptitude for programming increased (or decreased), speed in keystroking also increased (or decreased).

TABLE 3

RESULTS RELATING TO RESEARCH QUESTIONS

CORRELATION MATRIX FOR MANUSCRIPT 3

	GWPM	Typo Errors	Other Errors	Total Errors
Timing #3 GWPM	**.532** [1]			
Timing #3 Errors		**.374** [2]	**(.328)** [2]	**.387** [2]
Programming Aptitude	.248 [3a]	.002 [3b]	-.213 [3b]	-.144 [3b]
Computer Literacy	-.114 [4a]	**(-.337)** [4b]	**-.493** [4b]	**-.483** [4b]
Attitude to Computers	.228 [5a]	**.423** [5b]	.275 [5b]	**.372** [5b]
Attitude to Word Processing	**.492** [6a]	.189 [6b]	-.184 [6b]	-.043 [6b]

Significant correlations are shown in bold type, and trends are in brackets.

For each correlation the research question number is given.

Computer Literacy and Accuracy in Keystroking: Correlation coefficients of -.391 for Timing 1 and -.413 for Timing 3 and computer literacy were obtained, thus indicating that as students' knowledge of computer literacy increased, they made fewer errors. Where their knowledge of computer literacy was lower, they made more keystroking errors.

Speed and Accuracy in Keystroking: Correlation coefficients of .459 (Timing 2) and .434 (Timing 3) were determined, thus indicating a positive relationship between students' speed in keystroking and their accuracy in keystroking. That is, the faster students typed, the more errors they made.

Attitude to Computers and Accuracy in Keystroking: A significant r was obtained for only one timing (.418 for Timing 2), indicating that when attitude to computers was more positive (or more negative), students made more (or less) keystroking errors.

Word Processing Typographical and Other Errors: The relationship between typographical and other errors was significant only for Manuscript 3 (r of .581), indicating that typographical errors increased (or decreased) as other errors increased (or decreased) in this manuscript.

Word Processing Typographical and Total Errors, and Other and Total Errors: Significant positive correlations were obtained in all manuscripts. This was to be expected, since total errors was the sum of typographical and other errors.

Computer Skills and Attitudes: There were no significant relationships between programming aptitude, computer literacy, attitude to computers, or attitude to word processing.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Introduction

In this chapter the results of the investigation are discussed in relation to the research questions for the three manuscripts, the supplemental results are considered, and conclusions are drawn.

Some computer assisted instruction (CAI) courseware packages in keyboarding are then examined for their treatment of some of those skills which were found in this study to be necessary for word processing.

Finally, the limitations of the study are considered and suggestions for further research given.

Discussion of Results

The Main Questions

Three major questions were examined in this study. The first was to determine if speed and accuracy in keystroking were related to word processing speed and accuracy skills. The second was to see if aptitude for programming and computer literacy were related to word processing speed and accuracy skills. The third was to determine if students' attitudes to computers and word processing were relted to word processing speed and accuracy skills.

Relationships between keystroking skills and word processing production work:

Speed in Keystroking was strongly related to word processing speed. There were consistent positive correlations ranging from .492 to .532 on all three manuscripts. This suggests that a student's keystroking speed skill is very important in typing word processing production jobs.

Accuracy in keystroking also was related to word processing accuracy.

Only in Manuscript 1, which contained ordinary words which the student may have typed before, was there no relationship.

In Manuscript 2, which contained some technical words and special characters, thereby adding an extra element of more difficult keystroking, there was a positive relationship between accuracy in keystroking, measured by number of errors, and word processing typographical errors; and a positive trend between accuracy in keystroking and total manuscript errors.

In Manuscript 3, which contained ordinary words but more word processing tasks, thus adding an extra element of more word processing manipulation, a similar relationship between accuracy in keystroking and word processing typographical and total errors was evident, and in addition, a trend between accuracy in keystroking and word processing other errors.

In Table 4, it can be seen that students made the fewest errors both in the typographical and other errors category in Manuscript 1, more errors in both categories in Manuscript 2, and the most errors, again in

TABLE 4

MEANS OF TIMING AND MANUSCRIPT ERRORS

Errors	Manu 1	Timing 1
Typographical	1.39	14.97
Other	5.45	
Total	6.84	14.97

Errors	Manu 2	Timing 2
Typographical	2.45	17.58
Other	6.16	
Total	8.61	17.58

Errors	Manu 3	Timing 3
Typographical	2.58	15.16
Other	10.61	
Total	13.19	15.16

both areas, in Manuscript 3. They also made considerably fewer typographical errors in their manuscripts than in their timings.

In total, the results suggest that accuracy in keystroking was not related to word processing accuracy when the job was fairly straightforward, thus allowing the students to concentrate more on accuracy. However, as the complexity of the task increased, students who were more inaccurate in keystroking made more typographical errors and possibly more other errors also in their word processing manuscripts. It appeared they were distracted by the more difficult keystroking needed and the required word processing functions from concentrating on keystroking accuracy.

Relationships between computer skills and word processing production work:

Aptitude for Programming was not related to word processing speed or accuracy. There was only one significant correlation, found in Manuscript 2, between programming aptitude and word processing speed, which indicated as programming aptitude increased (or decreased), so did the word processing speed.

Computer Literacy was related to word processing speed only in Manuscript 2. As students' knowledge of computer literacy increased, their speed on the manuscript with more difficult keystroking decreased; and vice versa. One possible explanation for this is that students learned in computer literacy courses that accuracy was important when entering information into a computer, so when they had to type unfamiliar words, they sacrificed speed for accuracy.

The relationship between computer literacy and word processing accuracy was evident in all three manuscripts.

In Manuscript 1 there was a trend towards a negative relationship between computer literacy and word processing typographical and total errors. In Manuscript 2 there were significant negative relationships between computer literacy and word processing typographical, other, and total errors. In Manuscript 3 negative relationships between computer literacy and word processing other and total errors were again significant, while there was also a trend towards a negative relationship between computer literacy and word processing typographical errors. This would appear to indicate that knowledge of computer literacy is not as important in word processing accuracy when the job is fairly straightforward and more like a job on a typewriter. However, when the jobs become more complex, both when keystroking becomes more difficult and when word processing functions are required, other errors decrease as computer literacy knowledge increases. Typographical errors also tend to decrease. This indicates that students who know more about computers and programming are using the capabilities of the word processor to help them reduce other errors significantly and typographical errors to a lesser extent. It also suggests that students with a knowledge of computer literacy understand the need to communicate information to a computer accurately.

<u>Relationships between attitudes and word processing production work</u>:

<u>Attitude to Computers</u> was not related to word processing speed, and only very slightly to word processing accuracy. There were only two significant correlations, both found in Manuscript 3, between attitude to

computers and word processing accuracy; specifically, typographical and total errors. As attitude towards computers became more positive, typographical and total errors increased; and vice versa. A possible explanation is that students with a positive attitude to computers, on the manuscript with more word processing functions, concentrated more on the formatting of the job, which had more computer involvement, and tended to ignore the typographical errors, which they may have felt were secondary.

Attitude to Word Processing had a slight relationship with word processing speed. On Manuscript 1 there was no relationship; on Manuscript 2 there was a trend only; and on Manuscript 3 there was a significant positive relationship. Therefore, as the complexity of the job increased, the word processing speed increased with a positive attitude towards word processing. This shows that as the need to use the word processing features increased, students finished their manuscripts faster if they had a positive attitude towards word processing. It may be that they had a good attitude because they could do well.

No relationship was found between attitude to word processing and word processing accuracy.

Supplemental Results

Programming Aptitude and Speed in Keystroking have a positive relationship in all three timings. The test instruments that measured both were partly or entirely timed. Thus, it may be that aptitude for programming correlates with speed in keystroking simply because the students need similar abilities to complete tasks quickly in order to obtain high scores in both of these measures.

Computer Literacy and Accuracy in Keystroking are positively related in two timings, namely Timings 1 and 3. This corroborates the findings of correlations between computer literacy and manuscript accuracy where it was suggested that students with a knowledge of computer literacy understood the importance of entering accurate information on a computer.

Speed and Accuracy in Keystroking are related on two of the timings. It was expected that these two variables would show significant correlations because it is well known that a reduction in speed generally leads to a reduction in errors. However, no plausible reason can be advanced for the absence of a significant correlation in the other timing, other than that students' speed in keystroking skills can vary widely from one measurement to the next. It is the fact that keystroking skills can vary considerably that leads typewriting teachers to average a number of timings when they wish to determine the students' speed and accuracy keystroking skills.

In this research, a significant r of .400 is obtained when the mean timing speed and the mean timing errors are correlated. Thus, overall on all the timings, there is a significant relationship between speed and accuracy in keystroking.

Word Processing Speed and Accuracy are not related in any of the manuscripts. A possible explanation for the lack of a relationship is that students had the use of the Speller to easily detect and correct typographical errors, and the use of the word processor functions for correction of other errors. Use of both of these facilities takes varying lengths of time depending both on the student's ability with the task and with the word processor. The fact that there were no significant correlations here could indeed indicate that the students were using the Speller and the editing features of the word processor.

Attitude to Computers and Accuracy in Keystroking are related only in one timing. Because there were two timings for which no significance was found, it appears that this is not an important finding. It could be interpreted as a reinforcement of the findings relating to attitude to computers and word processing accuracy, or it could merely be due to chance.

Word Processing Typographical and Other Errors showed a positive relationship only in Manuscript 3. Thus, on the manuscript with more word processing moves required, students who made more other errors also made more typographical errors. It would seem that if the students had problems with the word processing moves, they were distracted by these from producing what they did type accurately. On the other hand, students who had fewer problems handling the word processing part of the document were less distracted and, therefore, produced a document with fewer typographical errors.

Conclusion

This study was designed to determine the effects of keystroking and computer skills and attitudes on word processing production efficiency. It was limited to one grade only in advanced typewriting classes where students were using a microcomputer and one particular piece of word processing software. The conclusions relate only to this study and should not be projected beyond its scope. They are:

1. Keystroking speed is very important for speed in word processing production work. The correlations for speed in keystroking and speed in word processing production work were high and were consistent for all three of the tasks.
2. Keystroking accuracy is important for accuracy in word processing production work, although not as important as keystroking speed is for production speed. The correlations for keystroking accuracy and word processing production accuracy were lower than for speed, and were not consistent for all tasks. Therefore, it was found that accuracy in keystroking became more necessary when the word processing production task became more complex.
3. Aptitude for programming does not relate to word processing production speed or accuracy significantly.
4. Knowledge of computer literacy is important for accuracy in word processing production work. Like keystroking accuracy, it is more important when the production tasks are not straightforward. Computer literate students seem to be aware that one must be very exact in communicating with a computer.
5. Attitude to computers does not relate to word processing production speed or accuracy significantly. However, attitude to word processing slightly affects speed in word processing production work when the task is more complex.

The findings of this study indicate that of all the factors examined, keystroking speed was the most important and consistent for all types of word processing production jobs. It was further indicated that keystroking accuracy, knowledge of computer literacy, and attitude to word processing affected word processing production work but only as the tasks became more complex.

CAI Software in Keyboarding

Introduction

The findings in this study show that the keystroking skills of speed and accuracy are important in typing word processing production manuscripts.

The correlations for speed in keystroking are higher and more consistent than the correlations for accuracy in keystroking. Therefore, looking at both the findings of this study and other research discussed in Chapter 2, it appears that developing the keystroking skill of speed is still very important as production work is moved from the typewriter to the word processor. It remains important, but less so, to develop the keystroking skill of accuracy; this is needed more in the typing of complex jobs than when learning the keystrokes.

Therefore, when students learn keyboarding, they should learn speed keystroking immediately. This is suggested for three reasons. First, it appears that keystroking speed is important in the typing of word processing production work. Second, emphasizing speed teaches ballistic motions of striking the keys, which are necessary to develop speed, and which need speed to be learned (West, 1983). Third, keystroking speed, unlike accuracy, has proved to be amenable to direct training (Robinson et al, 1979). Accuracy in keystroking is dependent upon the student using the right techniques and the right speed (Robinson et al, 1979). It can be emphasized after the student has learned speed keystroking techniques and correct posture.

Because more and more students will be taught to keystroke on a computer through a combination of word processing and CAI keyboarding courseware, it was considered important to examine the software presently available for this purpose in relation to the findings of this and other studies.

Present Keyboarding Software

There are many CAI keyboarding programs on the market today for many different computers. In a search for these programs, the investigator found 71 CAI programs. Of these, 45 programs taught keystroking to the user; 22 were drill and practice or timings; and details of the other four were unknown except for their names and the fact that they had received unfavorable evaluations (Alberta Education, Jan. 1983 - May, 1985).

There are basically three types of programs (Knapp, 1984):

1. Comprehensive

   Self-contained courses needing no supplementary materials.

   No teacher help required.

2. Short Tutorials

   Minimal instruction on the basics, but plenty of practice drills for newly introduced keys.

   Direct teacher assistance required.

3. Game Format

Very little instruction on the basics. Focus on increasing the user's speed at typing single characters and short combinations of characters.

Teacher help required on basics and introduction of keys.

Evaluations were found on 18 keyboarding tutorials (Schmidt and Stewart, 1983; Lambrecht and Pullis, 1983; Knapp, 1984; Owston, 1985; and Alberta Education, 1983-1986). In addition, the investigator personally evaluated 19 keyboarding tutorials for the Apple II Plus, Apple IIC, Apple MacIntosh, Commodore 8032, and IBM PC microcomputers. These tutorials were keyboarding software available to the investigator through The Calgary Board of Education, the Computer Applications Unit at the University of Calgary, Canadian Center for Learning Systems (CCLS), and those available in software stores in Calgary.

Also, the York University On-Line Service (Owston, 1985) provided descriptions of all tutorials in their data base although evaluations were not often provided.

Evaluation

Of the 37 keyboarding tutorials examined, it was possible to detect treatment of speed and accuracy in keystroke learning in 30 of the programs.

Of these, 25 emphasized accuracy. This was done in 14 programs by demanding total accuracy (not allowing the student to continue until the correct character was typed); and in 11 by a variety of devices including making a discordant noise, flashing incorrect characters, printing an arrow or similar character immediately under each incorrectly typed key, or printing accuracy statistics such as keys missed or percentage correct after each line or drill.

Only five typing programs allowed the student to type for speed. In these, the student was allowed to complete the typing of an entire line or sentence or paragraph without any interruptions. In some cases, if too many errors were made, such as more than three for every 30 characters, the student was asked to re-type the text. This was done to stop students from typing nonsense.

Therefore, it can be seen that most of the CAI programs examined were not consistent with the research findings in their treatment of speed and accuracy.

Limitations of the Study

This study was limited to one grade level in one school system in an urban area. Its sample was fairly small because word processing in high schools was relatively new to the area, and as a consequence, the word processing classes in the high schools were small. However, as many students were included as was possible. The students were also limited to one sex.

The hardware was limited to the use of a general-purpose microcomputer; stand-alone word processors were not used. The software was limited to one word processing software package.

The tasks were limited due to the time the classroom teachers were willing to set aside for the study.

Lastly, this was not a standards study. No attempt was made to determine students' expected speed and accuracy levels in either keystroking or word processing production work.

Suggestions for Further Research

There are a variety of studies which could be carried out and which would help to advance the research in this area.

First, to determine if the same results would apply, this study could be replicated at other grade levels in junior high schools, high schools, or post-secondary institutions; in other school systems, including rural as well as urban; using other hardware systems and other word processing software packages; and with both boys and girls.

The research procedures and design employed in this study could be applied to other word processing tasks, such as letters and tables, to determine if the same results would occur.

A similar study could be undertaken which allows students to correct errors in the measure of keystroking to see if it would have a significant effect on keystroking speed and accuracy. This is suggested because students may need to concern themselves less with initial keystroking accuracy as word processing becomes more widely used.

A study that controls previous knowledge, particularly the number of hours of typewriting and computer instruction that the students had received, would be most interesting.

Because language skills including business English, vocabulary, spelling, and proofreading are generally agreed as being necessary skills for word processing, a study could be undertaken to determine if they are as necessary as they were when typewriters were used for the production of written documents. This is suggested because word processing users have access to special tools such as the Speller and Thesaurus that people using typewriters do not; and there could be, therefore, a change in the relative importance of these skills with the introduction of the new technology.

When using a typewriter to produce a written document, there are basically three tasks which must be performed. They are, in order of importance: planning, proofreading, and keystroking (West, 1983). It would be useful to determine through a study if this order of importance would change for word processing production typing.

Finally, if a larger sample could be obtained, it is suggested that a similar study be done which would analyze the data using linear regression analyses, which could provide more definite information about the relationships of the variables used in the study.

The findings of this study are consistent with other research done in this area as enumerated in Chapter 2; that is, whether using a typewriter or a word processor, keystroking speed is of first importance and accuracy second for efficient typing of production work. In addition, it was also found that computer literacy knowledge and a positive attitude to word processing were also necessary for the efficient production of more complex jobs on a word processor.

REFERENCES

Alberta Education. Computer Courseware Evaluations: January, 1983 to May, 1985. Edmonton, AB.

Alberta Education. Computer Courseware Evaluations: June, 1985 to March, 1986. Edmonton, AB.

Alberta Education. Computer Courseware Evaluations: April, 1986 to December, 1986. Edmonton, AB.

Alberta Education. Typewriting 10-20-30. Business Education Curriculum Guide, 1985.

Anderson, R.E. Perspectives on computer literacy. In R.J. Seidel, R.E. Anderson, and B. Hunter (Eds.), Computer Literacy: Issues and Directions for 1985. Toronto, ON: Academic Press, 1982.

Anderson, R.E. and Klassen, D.L. A Conceptual framework for developing computer literacy instruction. AEDS Journal, Spring, 1981, 14, pp. 128-150.

Anderson, R.E., Krohn, K., & Sandman, R. User Guide for the Minnesota Computer Literacy and Awareness Assessment. St. Paul, MN: Minnesota Educational Computing Consortium, 1980.

Anderson, R.I. Word processing. In M.H. Johnson (Ed.), The Changing Office Environment. Reston, VA: National Business Education Association, 1980.

Barton, S.J. (1985). Competencies, Locus of Training, Job Qualifications, and Company Training Programs for the Correspondence Secretary as perceived by Correspondence Secretaries, Word Processing Supervisors, and Postsecondary Word Processing Instructors in Ohio. Dissertation Abstracts International, 46/06A, 2455. (University Microfilms No. DDJ81-26266)

Bergerud, M. and Gonzaliz, J. Word Processing: Concepts & Careers (2nd Ed.) Toronto, ON: John Wiley & Sons, 1981.

Billings, K. and Moursund, D. Are You Computer Literate. Beaverton, OR: Dilihium Press, 1979.

Chemical Abstracts. Columbus, OH: American Chemical Society, 1917-1985.

Cooper, W.E. Introduction. In W.E. Cooper (Ed.), Cognitive Aspects of Skilled Typewriting. New York, NY: Springer-Verlag, 1983.

Curley, D.M. Now is the time...to teach computer applications. Business Education Forum, April, 1986, 40, pp. 13-14, 16.

Curley, D.M. Using microcomputers to do word processing. Balance Sheet, January-February, 1984, 65, pp. 15-17.

Ellis, B.H. Word Processing Concepts & Applications. New York, NY: Gregg Division of McGraw Hill, Inc., 1980.

Eraser. In The New Encyclopædia Brittanica, Micropædia (15th Ed.). Chicago, IL: Encyclopædia Brittanica, Inc., 1986, p. 535.

Établissements P. Orange et Cie. Gomme à effacer ou à détacher (Patent Number 695.188). Paris, France: Ministère du Commerce et de l'Industrie, 13 December, 1930.

Ettinger, B. A study of the requirements and business training procedures for word processing personnel with implications for word processing curriculum development in a two-year post secondary institution. Delta Pi Epsilon Journal, July, 1982, 24, pp. 96-116.

Ferguson, G.A. Statistical Analysis in Psychology & Education (3rd Ed.). Toronto, ON: McGraw Hill Book Company, 1971.

Gronlund, N.E. Constructing Achievement Tests (3rd Ed.). Englewood Cliffs, NJ: Prentice-Hall, Inc., 1982.

Hart, B.D. (1971). Evolving Terminology and Associated Methodology of the Basic Skills Employed in the Teaching of Beginning Typewriting. Dissertation Abstracts International, 33/01A, 222. (University Microfilms No. 72-20016)

Holley, J.L. Word processing: who and what? Journal of Business Education, January, 1982, 57, pp. 130-133.

I.S.L. Typewriter. In Encyclopædia Brittanica (Vol. 22). Chicago, IL: Encyclopædia Brittanica, Inc., 1971, pp. 442-444.

Johnson, I.W. (1981). Effects of Keystroking, Planning, and Error Correction on Proficiency at Typing Business Letters of Varying Difficulty. Dissertation Abstracts International, 46/05A, 1169. (University Microfilms No. DER85-14695)

Jones, W.E. Eraser, Erasing Material, and a Method of Forming the Same (Patent number 2,164,035). Chicago, IL: United States Patent Office, June 17, 1939.

Knapp, L.R. Finding the best typing tutorials. Classroom Computer Learning, September, 1984, 5, pp. 70-71.

Lambrecht, J.J. and Pullis, J.M. Computer assisted instruction in typing. Educational Computer Magazine, May-June, 1983, pp. 42-45, 66-68.

McLean, G.N. Teaching Keyboarding/Typewriting (2nd Ed.). St. Paul, MN: Delta Pi Epsilon, 1984.

Menzies, H. Computers on the Job: Surviving Canada's Microcomputer Revolution. Toronto, ON: James Lorimer & Company, 1982.

Merrier, P. Pre-employment testing for word processing: what business does. Delta Pi Epsilon Journal, April, 1983, 25, pp. 74-82.

Merrill, P.E. Typewriter. In Encyclopedia Americana (International Ed., Vol. 17). Danbury, CN: Grober Incorporated, 1985, pp. 320-322.

Nyberg, V.R. and Clarke, S.C. School Subjects Attitude Scales (Administrator's Manual). Edmonton, AB: Planning Services, Alberta Education, July, 1983.

Ober, S. The difficulty level of typewritten copy in industry. Delta Pi Epsilon Journal, 1983, 25, pp. 1-8.

Osgood, C.E. The measurement of meaning. In J.G. Snider and C.E. Osgood (Eds.), Semantic Differential Technique. Chicago, IL: Aldine Publishing Company, 1969.

Ownby, A.C. Typing skills needed in the automated office. Business Education Forum, April, 1982, 36, pp. 9-10, 12.

Owston, R.D. (Director). York University Faculty of Education On-Line Service. North York, ON: York University Faculty of Education, 1985.

Pawloff, R.W. Computer Literacy: What is it all About (1981 Annual Conference, ATA Mathematics Council, Lethbridge, AB).

Poplin, M.S., Drew, D.E., and Gable, R.S. CALIP: Computer Aptitude, Literacy, & Interest Profile. Austin, TX: Pro-ed, 1984.

Randhawa, B.S. and Hunt, D. Computers and computer literacy in contemporary psychological, socio-economic and educational context. Aeds Journal, Spring, 1984, 17, pp. 1-13.

Robertson, J.R. and West, J.F. Attitudes/skills business educators should update. Journal of Business Education, January, 1984, 59, pp. 163-167.

Robinson, J.W. The relation of copy difficulty to typewriting performance. Delta Pi Epsilon Journal, 1967, 9, pp. 9-24.

Robinson, J.W., Erickson, L.W., Crawford, T.J., Beaumont, L.R., & Ownby, A.C. Typewriting: Learning and Instruction. Cincinnati, OH: South-Western, 1979.

Schmidt, B.J. and Stewart, J.R. Microcomputer typewriting in business education. Business Education Forum, March, 1983, 37, pp. 29-30.

Shelly, G.B. and Cashman, T.J. Computer Fundamentals for an Information Age. Brea, CA: Anaheim Publishing Company, Inc., 1984.

Spencer, D.D. Computers in Action. Rochelle Park, NJ: Hayden Book Company, 1978.

Stallard, J.J., Smith, E.R., and Reese, D. The Electronic Office. Homewood, IL: Dow Jones-Irwin, 1983.

Sterling, T.D. and Pollack, S.V. Computing and Computer Science. Toronto, ON: Collier-Macmillan Canada Ltd., 1970.

Stern, R.A. and Stern, N.B. Principles of Data Processing. Toronto, ON: John Wiley & Sons, Inc., 1973.

Van Dam, A. and Meyrowitz, N. Text editing systems. In A. Ralston and E. Reilly, Jr. (Eds.), Encyclopedia of Computer Science and Engineering (2nd Ed.). New York, NY: Van Nostrand Reinhold Company Inc., 1983, pp. 1495-1500.

Wagoner, K.P. Word processing and the future. Journal of Business Education, March, 1982, LVII, pp. 220-224.

West, L.J. Acquisition of Typewriting Skills: Methods and Research in Teaching Typewriting. Toronto, ON: Pitman Publishing Corporation, 1969.

West, L.J. <u>Acquisition of Typewriting Skills: Methods and Research in Teaching Typewriting and Word Processing</u> (2nd Ed.). Indianapolis, IA: Bobbs-Merrill, 1983.

Williams, M.R. <u>A History of Computing Technology</u>. Toronto, ON: Prentice-Hall Canada Inc., 1985.

Wooldridge, S. <u>Computer Input Design</u>. New York, NY: Petracelli Books, 1974.

APPENDIX A

MANUSCRIPTS AND STRAIGHT-COPY TIMINGS

MANUSCRIPT #1

The following manuscript is not formatted. Right justify. Please type it in correct manuscript style:

To Write a Report

By Jennifer Brown

The Introduction

The selection of the most suitable type of research is a critical factor in the success of the final report with all its conclusions and recommendations.

A Chronological Report

The person who writes a report which records happenings in the order of their time sequence is involved in writing a chronological report. **New Paragraph** It is definitely important in writing such a report to keep in mind that events sometimes follow one another in successive points of time without moving toward a common end. **New Paragraph** There may often be some temptation to find cause and effect relationships where no evidence lies for such a conclusion. The report should be limited to facts without assuming relationships among the facts. Such research should indicate origin, history, and development.

Save this manuscript on your Word Perfect Data Diskette, called: doc1

MANUSCRIPT #2

The following manuscript is not formatted. Right justify. Please type it in correct manuscript style:

The Fossil Person

Modern Primates

By Michael H. Day

Tree Shrews (Tupaia)
These small, primitive squirrel-like primates come from South East Asia, west of Wallace's line. They have eye sockets (surrounded by a bony ring) and even a second "tongue" (the sublingua), like lemurs.
Lorises
These nocturnal group of primates include the slow loris (Nycticebus), the potto (Perodicticus), and the "bush babies" (Galagos). **New Paragraph** The galagos are found in Africa--and the other lorises in Africa and South Asia. The Galagos are active leapers, while all the other lorises are slow movers.
Lemurs
Found only on the Island of Madagascar, the lemurs are quite gentle beasts with almost no enemies except man. There are many varieties from the small mouse lemur (Microcebus) to the "monkey-sized" Indri. The best known is ring-tailed.

Save this manuscript on your Word Perfect Data Diskette, called: doc2

MANUSCRIPT #3

The following manuscript is not formatted. Please type it in correct manuscript style, but do not right justify:

The Home Computer

A Necessary Tool for Today

It is anticipated that within the coming years, the home computer will become as common as the ~~TV~~ television set.

Home computers were first introduced in 1975 in kit form and had to be assembled before use.

Single space and indent 5 strokes from each margin.

Composition

Normally they consist of keyboards, processor units, CRT display screens, and auxiliary storage devices, usually floppy disk drives or cassette tape drives. **New Paragraph** ~~Extra~~ Additional input units such as joysticks and graphics pads are also quite available. **New Paragraph**

Cost: The basic keyboard and processor unit for many home computers can be purchased for ~~≤~~ less than $100*, although more typically these units cost between $200* and $700*. An entire system could sometimes cost in the neighborhood of $500* to $1500*. **New Paragraph** Many people today have their own computer.

Put all money amounts and dollar signs in bold.

Leave 2 blank lines.

Move this sentence to

*In Canadian dollars ← Right justify.

Save this manuscript on your Word Perfect Data Diskette, called: doc3

TIMING PRACTICE

PRESS RETURN

In learning keyboarding, how you practice is just as important as the many words you produce on paper. How you practice is determined largely by the level, or speed, of your daily practice. Altogether, there are three levels of practice in keyboarding: exploration level, control level, and optimum level.

When the practice goal is to go beyond the speed of typing accurately and to discover newer and faster patterns of keyboarding, use the exploration or high-speed level. Try to force letter-sequence motions closer together in time even though you make many errors.

When the purpose of practicing is typing with fewer errors, decrease your speed a few words a minute and work with absolute comfort and confidence on the control level. Control means more than absence of error in copy produced, however; it means implicit control over typist reading habits and precise finger movements for accurate copy in typewriting.

The optimum or in-between level is somewhere between the exploration level and the control level. It is a performance level speed that is fairly easy maintaining without undue tension or ultimate stress. When you attempt to work at this in-between rate, make every effort to keep the element or carriage moving at a steady pace and abolish jerks and pauses.

When practicing first on the exploration level and second on the control level, you are desirably separating the two different goals of speed and accuracy. When you typewrite at the optimum level, however, you always attempt to type at your absolute best, but not highest speed, with an error tolerance that is acceptable. According to a research study by Weise, it is the correct and timely use of practice levels, rather than the use or nonuse of repetition, that leads most rapidly to the final ultimate attempt of speed with accuracy.

The exploration and the control levels thus are used mostly to build skill while the optimum level is used periodically to measure skill.

TIMING #1

PRESS RETURN

Imagine being able to ride and travel in a cylindrical space capsule! Although the astronaut acknowledges that he is hurling through the outer reaches at speeds that are incredible, he doesn't feel that he is travelling very rapidly. Travelling in space is very different from journeying in automobiles, trains or buses. Leafy or barren trees, statuesque buildings, telephone poles, towering grain elevators, people of every description, impressive bridges, rapidly flowing rivers and other objects can be seen as you whiz by them on land. Bumps and ridges in the pavement or gravel can be felt as the vehicle passes over them. In space, there is no sensation of movement. Neither are there any objects, interesting or otherwise, to gaze upon in the outer reaches. A space traveller can peer out of the capsule's porthole, only to see nothing. It is impossible to tell whether or not you are really moving. Speed is not realistic.

The intrepid astronaut at home probably has a total body weight that is obviously average. However, in deepest space, he can no longer feel the pull of gravity on his body or clothing; therefore, he simply floats. There is really nothing to hold him in his comfortable seat or to keep him solidly upright in the spacecraft. On our planet Earth, the immensely important force of gravity keeps us always on the ground. In outer space, a traveller is levitating like balloons filled with oxygen, hydrogen, and nitrogen. The courageous astronaut must use unbelievably special equipment to overcome the floating sensation. His movements are exact, with no mistakes. He must control his zealous actions, or he would be floating in excessively awkward positions, perhaps around in circles, upside down, or on the capsule's ceiling. Imagine trying to eat dinner!

When the exhausted but energetic astronaut decides he must exercise, he uses special equipment. Without this equipment, if he attempted to bend over and touch his ankles without gravity's aid, he would naturally turn over. His head would go downward and his feet upward. Therefore, in the space capsules, there are specially designed clamps and devices for astronauts to use for exercise. These help keep their feet firmly downward while exercising for the physical and mental well-being of the space travellers.

TIMING #2

PRESS RETURN

Writing reports need not be the awful ordeal so many of us fear it to be and can sometimes find it to be. Like a multitude of many other things, it isn't nearly so difficult if we break it down into small segments. The purpose of the timings in these exercises is explaining how to write reports systematically. While every suggestion probably will not be necessary for each report, the principles presented will undoubtedly be generally useful.

A report should be written in a constructive manner. Instead of repeating cliches or plodding through a tale of a meeting or a convention, it is a lot more interesting to offer simple, thought-provoking concepts and ideas.

To prepare an excellent report, you need to be dependable, patient, resourceful, and hard-working. This is the real recipe for holding the interest of listeners and readers. It is really the only way to convey to others the results of your laborious research.

There are, in reality, only two kinds of reports for business: first, the information report; and second, the research report.

The information report is to keep a person quite up to date with events, developments and projects. The research report is the outcome of your investigation of a certain topic of interest. This might include any area of a human activity, from politics to labor relations, from a thought on recycling energy to finding new ways to use available energy, or from a concept on typing to new ways of word processing.

Any report upon which action is based, or which may influence executives in one direction or another, is a very important piece of work and deserves our total, utmost attention. There are few more interesting occupations than that of searching for material to be used in such a report.

The work of expressly writing a report begins long before making a move for writing instruments or toward the keyboard. Authors must understand exactly what is wanted and why it is wanted. The report must address definite and limited problems.

TIMING #3

PRESS RETURN

Almost all the millions of folk who operate typewriters or word processors in business offices are known as overhead. They process documents and do many things necessary to keep the company going, but don't bring in income. They are overhead--an expense--and most companies try to reduce expenses.

One way of cutting costs is to help employees be more productive. This includes typists and word processors. Most firms that manufacture typewriters have thus produced many modifications of office machines to help the typist get more done. The typist should know the major variations in today's typewriters.

The most obvious variation in the typewriter is in its size. In addition to the standard office machine, there are portables and compacts.

The portable, so easily stored away and taking so little space, is used as the main writing instrument in many thousands of personal home offices such as doctors and executives, laboratories, drugstores, libraries, and so on. Manual portables are stiff when new and require the typist to snap each key sharper than is necessary on an office machine to get good, clear printing.

The compact is half way between a portable and a standard machine. It is a bit like a heavy-duty electric portable, or perhaps a light-weight electric standard; and it is electric.

When buying a new typewriter or word processor, a customer has many options from which he can choose. The office typist is likely, therefore, to be required to operate a machine with unexpected features.

Special cylinders can be purchased for absolutely every type-writer, electric or manual, for sustained typing of letters, stencils, labels, and other special tasks. Snapping the two catches on the carriage, the cylinder is released and lifted out. Special tab keys located in a row across the keyboard can be provided for some typists to help them align amounts in columns on an account.

APPENDIX B

A STUDENT QUESTIONNAIRE ON COMPUTER LITERACY

INSTRUCTIONAL OBJECTIVES AND

STUDENT BEHAVIORAL OUTCOMES

<u>A STUDENT QUESTIONNAIRE ON COMPUTER LITERACY</u>

SECTION A: BACKGROUND INFORMATION

Name:________________________________ Grade:____________

Age:________ Sex:________ Typing 20 Mark:____________

Course Name:____

<u>Computer Courses Taken to Date</u>:
- a) Elementary School:
  Approximate number of hours worked on computers:______
- b) Junior High School:
  Approximate number of hours worked on computers:______
- c) High School:
  Name of Course(s):____________________________________
- d) Computer Club:
  Approximate number of hours:________________
- e) Computer Camp:
  Approximate number of days:_________________

<u>Do you have access to a computer outside of school</u>?
Yes No
If yes, approximately how many hours per week do you use it?____________

<u>Before you took this course, how much time had you spent on a computer in any capacity (programming, games, using the computer to learn, word processing, etc.):</u>
- a) None
- b) Less than 20 hours
- c) 20 - 50 hours
- d) More than 50 hours

<u>How much time have you spent playing computer games, including video and arcade games</u>:
- a) None
- b) Less than 20 hours
- c) 20 - 50 hours
- d) More than 50 hours

<u>How much time have you spent programming a computer:</u>
- a) None
- b) Less than 20 hours
- c) 20 - 50 hours
- d) More than 50 hours

<u>How much time have you spent on a computer for word processing</u>:
- a) None
- b) Less than 20 hours
- c) 20 - 50 hours
- d) More than 50 hours

SECTION B: KNOWLEDGE OF COMPUTERS

Please answer each of the following questions. Circle the letter beside the correct answer:

1. An example of a special-purpose computer is:
   a) Apple IIE
   b) Stand-alone Word Processor
   c) IBM PC Junior
   d) Electric Typewriter

2. The physical parts of a computer are called:
   a) Software
   b) Courseware
   c) Hardware
   d) Dataware

3. Electronic components which make up the controlling circuitry of a computer system are stored on small pieces of silicon called:
   a) Keyboards
   b) Chips
   c) Wires
   d) Modems

4. One single piece of a computer's electronic circuitry that contains all the arithmetic and logic units is called:
   a) Microprocessor
   b) RAM (Random Access Memory)
   c) ROM (Read Only Memory)
   d) Hard Disk

5. The smallest unit of storage is called a:
   a) Byte
   b) Word
   c) Nybble
   d) Bit

6. Which of the following <u>CANNOT</u> be used as a device on which to permanently save programs and data:
   a) Floppy disk
   b) Cassette tape
   c) CRT Screen
   d) Magnetic disk

7. Which of the following <u>CANNOT</u> be used to input data into a computer system:
   a) Joystick
   b) Magnetic tape
   c) Floppy disk
   d) Line printer

8. Output devices are used by the computer to:
   a) Control the program
   b) Print or store the results of its processing
   c) Put data into the program
   d) Perform all the calculations

Knowledge of Computers Page 2

9. The first calculating device was the:
   a) Adding Machine
   b) Analytical Engine
   c) Keypunch Machine
   d) Abacus

10. Charles Babbage is the person who:
    a) Is credited with the idea of the modern computer
    b) Was the president of IBM when the decision was made to move into the computer field in 1955
    c) Is credited with first writing about the "stored program" concept
    d) Developed punched cards and data processing ideas used to process the U.S. Census data in 1890

11. The first digital electronic computer became operational:
    a) About the time the first television set was built
    b) At the end of World War II
    c) Shortly after Ben Franklin discovered electricity
    d) At the same time as the invention of the telephone

12. Which of the following is <u>NOT</u> an example of software:
    a) Circuit Boards
    b) Computer languages
    c) Compilers
    d) Operating systems

13. In solving a problem, a computer:
    a) Thinks exactly like a person
    b) Needs a flowchart to understand the problem
    c) Follows a program, written by people
    d) Usually recalls the answer from memory

14. A computer program is a:
    a) Piece of equipment on the computer
    b) Special kind of electronic circuitry
    c) Sequential set of instructions telling the computer what to do
    d) Set of computer manuals

15. Which one of the following can a computer <u>NOT</u> interpret:
    a) The BASIC language
    b) The English language
    c) An artificial intelligence language
    d) The C language

16. Computer processing of data may involve:
    a) Updating
    b) Deleting
    c) Sorting
    d) All of the above

17. To use a microcomputer as a word processor, you need:
    a) A word processing program
    b) Another microprocessor
    c) A computer language such as BASIC
    d) A modem

18. A word processor <u>CANNOT</u> be used to:
    a) Retrieve a document
    b) Edit a document on the screen
    c) Save a document
    d) Look up the meanings of words

19. In France, the telephone directory has been computerized, ie, all phone numbers have been placed in a computer data base which all people access for phone numbers. This was probably done because:
    a) It was too expensive to print phone books every year
    b) It was felt that people needed fast access to all phone numbers
    c) Phone books get out of date quickly
    d) All of the above are true

20. Computers in general are becoming:
    a) Smaller in size with more memory
    b) Larger in size with more memory
    c) Larger in size with less memory
    d) Smaller in size with less memory

21. If you receive a bill produced on a computer that has an error, the error could have been caused by:
    a) Incorrect data preparation
    b) Error(s) in the program
    c) Incorrect data entry
    d) All of the above

22. A computer programmer needs to be able to:
    a) Manage the Data Processing Department
    b) Write and find errors in computer language code
    c) Operate all the different types of computer equipment
    d) Repair the computer equipment

23. Computers are <u>NOT</u> useful for tasks which require:
    a) Handling large amounts of information
    b) Handling of information rapidly and accurately
    c) Generating new ideas
    d) Repetition

Knowledge of Computers Page 4

Read each of the following statements carefully and decide if it is true or false. If the statement is true, circle the word true beside the statement. If the statement is false, circle the word false beside the statement.

A.	A computer's random access memory stores data permanently.	True	False
B.	In reference to memory, 1 K refers precisely to 1024 bytes.	True	False
C.	Modems are used to access a computer from a distance.	True	False
D.	Program instructions and data can both be stored in RAM.	True	False
E.	You have to know how to program a computer before you can use it in any way.	True	False
F.	Computers are used in a wide variety of ways to assist individuals, groups, and institutions.	True	False
G.	People do not use computers to store large amounts of information they wish to use over and over again.	True	False
H.	As more and more computers are used in our society, some jobs are eliminated while other jobs are created.	True	False
I.	Computers can be used to invade your privacy, by helping to make information about you available.	True	False
J.	Computer crime always involves the stealing of computer equipment.	True	False
K.	Computers can provide us with the answers to every question.	True	False
L.	Computers cannot tell the difference between correct and incorrect behaviour.	True	False

You're doing well!

Keep on going

SECTION C: KNOWLEDGE OF BASIC PROGRAMMING

Please answer each of the following questions. Circle the letter beside the correct answer:

1. Which one of the following statements is not executed by the computer but is used to give explanations about how the program works:
   a) PRINT
   b) DATA
   c) REM
   d) LET

2. **PRINT "YOU HAD 10 WRONG."**
   What is the output for the above BASIC statement:
   a) "YOU HAD 10 WRONG"
   b) "YOU HAD 10 WRONG."
   c) YOU HAD 10 WRONG
   d) YOU HAD 10 WRONG.

3. There are two main kinds of variables in BASIC. Examples are given below. Which line has one example of each:
   a) A1 and B
   b) Z$ and P5$
   c) C2 and Y8
   d) F1 and R2$

4. A LET statement is used to:
   a) Assign a particular value to a variable name
   b) Compare two different variables
   c) Allow the user to input a variable value into the program
   d) Print the value of a variable

5. **PRINT 2 / 3 * 4**
   You would read the above line in BASIC as:
   a) Print 2 to the power of 3 divided by 4
   b) Print 2 times 3 to the power of 4
   c) Print 2 divided by 3 times 4
   d) Print 2 times the square root of 3 times 4

6. Which of the following is NOT a valid assignment statement in BASIC:
   a) LET D6="12345"
   b) LET M=1000
   c) LET G3$="Hello"
   d) LET K$="999"

SECTION C: KNOWLEDGE OF BASIC PROGRAMMING PAGE 2

7. **10 LET A = 5**
   20 LET B = 3
   30 LET A = 6
   40 PRINT A
   What is the output for the above program:
   a) 5
   b) 6
   c) A
   d) 3

8. **A - 3 / (B + C) * E**
   Which operator in the above arithmetic expression would be calculated LAST:
   a) -
   b) *
   c) /
   d) +

9. Which of the following arithmetic operations comes first in order of priority:
   a) Division
   b) Multiplication
   c) Addition
   d) Exponentiation

10. Line numbers in a BASIC program:
    a) Are determined by the programmer
    b) Can be typed in any numerical order
    c) Are executed sequentially
    d) Are all of the above

11. When you have typed a program into your computer and wish to keep it permanently on disk, you use the command:
    a) RUN
    b) STORE
    c) SAVE
    d) KEEP

12. When you wish to retrieve a program from your floppy diskette, you type the command:
    a) SAVE
    b) LIST
    c) NEW
    d) LOAD

SECTION C: KNOWLEDGE OF BASIC PROGRAMMING PAGE 3

13. When you wish the computer to display the lines in your program, you type the command:
a) TYPE
b) LIST
c) PRINT
d) COPY

14. The following command clears any program or data out of random access memory:
a) NEW
b) RUN
c) LIST
d) UPDATE

15. Which statement below does <u>NOT</u> put data into the program:
a) INPUT
b) LET
c) IF...THEN
d) READ

16.
```
10 LET S=2
20 FOR J=2 TO 5 STEP 2
30 LET S=S/J
40 NEXT J
50 PRINT S
```

What is the output for the above program:
a) 1
b) .25
c) 2
d) .04

17.
```
10 LET J=4
20 IF J<0 THEN GOTO 50
30 LET J=J-2
40 GOTO 20
50 PRINT J
```

What is the output for the above program:
a) -2
b) 0
c) 2
d) -4

SECTION C: KNOWLEDGE OF BASIC PROGRAMMING PAGE 4

18.
```
5 DATA 1,3,5,7,9,11,13,14,15,16,17
10 LET A = 1
20 READ J
30 IF ________THEN GOTO 999
40 LET A = A + 1
50 GOTO 20
999 END
```

Complete line 30 so that the program will read exactly 10 data values:
a) A = 9
b) A < 9
c) A = 11
d) A = 10

19. Which nested FOR/NEXT loop below is correct:

a)
```
10 FOR A = 1 TO 10
20 FOR B = 1 TO 2
50 NEXT B
60 NEXT A
```

b)
```
10 FOR J = 4 TO 1 STEP 2
15 FOR K = 1 TO 4
50 NEXT K
55 NEXT J
```

c)
```
10 FOR M = 1 TO 5
20 FOR N = 1 TO 5
100 NEXT M
110 NEXT N
```

d)
```
200 FOR Q = 10 TO 1
210 FOR R = 5 TO 1
310 NEXT Q
310 NEXT R
```

20. Which statement below always causes the program to branch to the same line number:
a) IF ... THEN
b) INPUT
c) GOTO
d) ON ... GOSUB

Thank you for completing this questionnaire!

INSTRUCTIONAL OBJECTIVES AND BEHAVIORAL OUTCOMES
FOR THE COMPUTER LITERACY QUESTIONNAIRE
SECTION B, KNOWLEDGE OF COMPUTERS

Hardware

Question

1. Distinguish and be able to identify special purpose from general purpose computers.
2. Recognize that computer hardware refers to the physical components of computer systems.
3. Recognize that chips contain electronic logic networks called circuits.
4. Recognize that a microprocessor is a single chip containing all the electronic logic of a CPU.
5. Recognize the distinctions among bit, byte, nybble and word.
6. Recognize secondary storage systems.
7. Recognize input devices.
8. Understand the role of output devices.

A. Identify the meaning of acronym RAM which identifies a particular type of memory.

B. Recognize both the loose and precise definition of "K".

C. Recognize the function of some basic communications technology, eg. modems.

History

Question

9. Recognize that the abacus was man's first calculating device.

10. Recognize that Charles Babbage developed the concept of the computer even though he did not build one that worked.

11. Recognize that the first large-scale digital electronic computer became operational shortly after World War II.

Software and Information Processing

Question

12. Identify that software refers to computer programs and includes operating systems, compilers, and user (application) programs.

13, 15. Recognize that a computer gets instructions from a program written in a programming language by a person.

14. Recognize that a computer needs instructions to operate.

16. Recognize that computers process data by searching, sorting, deleting, updating, summarizing, moving.

D. Recognize that a computer is capable of storing a program and data.

Applications

Question

17, 18. Recognize that word processing is a common type of application and that it involves storage and retrieval.

19. Recognize some advantages of using a computer for storage and retrieval of information (including continual up-dating and quick recall).

E. Recognize that a user of an applications program does not have to be a programmer.

F. Recognize that computers and computer-supported applications are used in a wide variety of ways to assist individuals, groups, and institutions.

G. Recognize that computers are generally useful for certain kinds of information-processing tasks.

Impact

Question

20. Recognize that computers are being made smaller while the amount of information they can hold will continue to increase.

21. Recognize that alleged "computer mistakes" are usually mistakes made by people.

22. Be aware of the more common computer-related careers such as computer programmer, computer operator, data entry clerk, and hardware technician.

H. Recognize that computerization both increases and decreases employment.

I. Identify some advantages or disadvantages of a data base containing personal information on a large number of people; ie, potential for invasion of privacy.

J. Recognize that computers are used to commit a variety of serious crimes, especially stealing money and stealing information.

Limitations

Question

23. Identify a number of things that computers cannot do or cannot perform efficiently.

K. Recognize that computers cannot provide answers to every question.

L. Recognize that computers cannot make value judgments.

INSTRUCTIONAL OBJECTIVES AND BEHAVIORAL OUTCOMES FOR THE COMPUTER LITERACY QUESTIONNAIRE SECTION C, KNOWLEDGE OF BASIC PROGRAMMING

Usage

Question

11. Use a command for an available computer system to save a file.
12. Use a command for an available computer system to retrieve a file from disk.
13. Use a command for an available computer system to list a file on screen.
14. Use a command for the programming language BASIC to clear RAM.

Programming/Algorithms

Question

1. Understand that BASIC remark statements are used in a program for the benefit of the reader.
2. For simple programs in BASIC, follow and give the correct output for a program containing output statements.
3. Recognize that there are two main variable types in BASIC.

4, 7, 15. For simple programs in BASIC, recognize data input statements and give the correct output for programs containing them.

5, 8, 9. For simple programs in BASIC, understand the order of priority of BASIC operators and be able to give the output of programs containing them.

6. Detect syntax and logic errors in an improperly functioning algorithm or program.

10. Understand how to use line numbers in a BASIC program.

16, 17, 20. For simple programs in BASIC, follow and give and correct output for programs containing repetition.

18. Modify a simple algorithm or program to accomplish a task.

19. Select an appropriate algorithm from a set of alternatives.

APPENDIX C

INSTRUCTIONS AND HANDOUTS

USED IN THE ADMINISTRATION OF THE EXPERIMENT

CALIP ADMINISTRATOR ORAL INSTRUCTIONS TO STUDENTS

Today, students, I would like you to complete a test called CALIP. It is a test that measures your aptitude for programming on computers. It consists of a profile and six subtests. You, however, will complete only four.

Because there is no penalty for incorrect answers, try to answer every question, even if you have to guess. If you find a question hard to do, just do the best you can. The results of this survey will not be used by your teacher to give you a mark in your course.

HAND OUT A FOLDER AND A PENCIL TO EACH STUDENT.

Please write your name on the label on the folder. Take out the Answer Booklet and complete the top part of page 1: Your name; address; place of current employment, if any; phone; today's date; your birthdate; and current age. Then, also fill out the Computer Experience Survey on the back of the Answer Booklet.

WHEN FINISHED;

Now, to start. Take out the Test Booklet. Look at the first page, #1 Estimation (Aptitude). Open your Answer Booklet to the first page, and find #1 Estimation (Aptitude). This is where you will mark your answers. Please write only on the Answer Booklet. This particular test measures the ability to estimate numbers both quickly and accurately. You are asked to estimate the sum of the darkened squares in each problem. Look at Example A at the bottom of Page 1 of your Test Booklet. How many darkened squares are there? **PAUSE** Now look in the Answer Booklet. See how the answer was written in the box.

Look at the second example, Example 2. Make a quick estimation of the number of darkened squares. **PAUSE** Now look at the Answer Booklet. You can see that there were five darkened squares on the first row and four darkened squares on the second row, making a total of nine. Nine was written in the box. Does everyone understand how to do this part? **PAUSE**

You will be given two minutes to work on the 24 items. When I tell you to begin, open the Test Booklet and begin.

Are you ready? Begin.

TWO MINUTES LATER: Stop.

You now have approximately 50 minutes to complete the remaining three subtests.

Turn to Page 5 of the Test Booklet for Subtest 2. This measures your ability to complete a graphics pattern. Look at the two examples. What are the answers? **DISCUSSION** Note on the Answer Booklet that the correct circle was filled in. Any questions on this part?

Now turn to Page 10 of the Test Booklet for Subtest 3. This test measures your ability to understand and complete logical structures. Look at the two examples. What are the answers? **DISCUSSION** Note how the answers were recorded on the Answer Booklet.

Now turn to Page 12 of the Test Booklet for Subtest 4. This test measures your ability to complete a numerical or logical series. Look at the two examples. What are the answers? **DISCUSSION** Note how the answers were filled in on the Answer Booklet.

Any questions? **PAUSE** When you have finished the subtests, put all materials in your folder and hand in your folder and your pencil. Begin.

INSTRUCTIONS FOR STRAIGHT-COPY TIMINGS

GENERAL INSTRUCTIONS:

You are to type a **5-minute** timing which you will find in your folder. Please type it as fast and as accurate as you can.

You are to type the timing using the program on the diskette in your folder. When typing:

- Space 5 times for each new paragraph (do not press TAB);
- Type line for line, and press Return ONCE after each line;
- Do not correct any errors.

HOW TO USE THE PROGRAM:

Put the Timing Diskette into Drive A (the drive on the bottom).

Close the drive door.

If the computer is off: Turn on the computer and the monitor.

If the computer is on: Press: **Ctrl/Alt/Del** (at the same time).

This loads the program.

When the program asks you to type your initials, type:
For Practice Timing: Your initials.05
For Timing #1: Your initials.1
For Timing #2: Your initials.2
For Timing #3: Your initials.3

For Example: Julia Blair would type:
For Practice Timing: JB.05
For Timing #1: JB.1
For Timing #2: JB.2
For Timing #3: JB.3

Please follow the instructions in the program carefully.

PROGRAM INSTRUCTIONS FOR STRAIGHT-COPY TIMINGS

INSTRUCTIONS

Please leave your diskette in Drive A.

Type line for line from your copy.
To indent paragraphs, space 5 times.
Press Return at the end of each line.
Do not try to correct errors.

Get out your timing sheet, ready to start.
When you are ready to type, press any key;
the computer will clear the screen and you
should start typing IMMEDIATELY.

The computer will allow you to type until
your time is up; then it will tell you your
gross words per minute, and save your timing
on your diskette.

Are you ready?

Press Any Key

STUDENT INSTRUCTIONS FOR TYPING THE MANUSCRIPTS

1. Get your WordPerfect template, WordPerfect program diskette and your Speller diskette.
   Take your WordPerfect Data Diskette out of your folder.

2. Please read this entire handout.

3. Put your WordPerfect program diskette in Drive A and your Data Diskette in Drive B. Load WordPerfect.

4. When you are ready to start your job, put up your hand; you will be given the manuscript to type. Please do not talk while you are typing the manuscript.

5. On the page marked: **Manuscript Times** , please fill out:
   Your Name
   The Date
   The Manuscript Number

6. Do not write on the manuscript copy. Scrap paper has been provided in your folder if you need it.

7. Please type this document as well as you can--try to type a perfect copy. Imagine that you are working in an office and must do this job for your boss.

8. Specific Instructions:
   Read the instructions at the beginning of the manuscript.
   For all the manuscripts, use a 72-stroke line (6" elite line).
   Use the Speller to help you find typographical errors.
   Please correct all your errors before handing in.

9. The teacher will keep track of how long it took you to do the manuscript. Try to type your manuscript as fast as you can; **but it should be error-free.**

When you have finished:

10. When you have finished your manuscript, **please save it on your WordPerfect Data Diskette**. You are not required to make a paper copy of your manuscript.

11. Put the WordPerfect Data Diskette back in its envelope in your folder; put the manuscript sheet back in the folder. Hand in your folder with the Manuscript Times to the teacher.

Thank you!

MANUSCRIPT TIMES

Name: ______________________________

Date: ______________________________

Manuscript #: ______________________________

Time Began: ______________________________

Time Ended: ______________________________

Total Time: ______________________________

APPENDIX D

DETERMINING ERRORS FOR

TIMINGS AND MANUSCRIPTS

DETERMINING ERRORS

The following is the procedure used for determining typographical errors for the 5-minute straight-copy timings and for determining typographical and other errors for the manuscripts.

TYPOGRAPHICAL ERRORS:

Counting Errors:

Count only 1 error per real word (ie, words are separated by spaces) even if there was more than one character typed incorrectly.

Insertion of extra text: count as 1 error.

Deletion of Text: count as 1 error.

If either insertion or deletion occurs in different places, count it as an error each time it occurs.

Transposition of letters or words: count as 1 error.

Fingers on wrong home row keys: count each word (ie, separated by spaces) typed incorrectly as an error.

Incorrect Word Division: count as 1 error per word.

Capitalization: count as 1 error per word if a character was capitalized or was not capitalized incorrectly.

Kinds of Errors:

Hitting Wrong Keys:

Incorrect letter, number, punctuation mark, or special character.

Strike-over.

Spacing Errors:

Two or more spaces between words;

No spaces between words;

Space within a word;

Space before a punctuation mark;

Anything other than 1 space after:

- period indicating an abbreviation;
- semi-colon;
- comma.

Anything other than 2 spaces after:

- period indicating the end of a sentence;
- colon (except in time, eg. 14:45);
- question mark;
- exclamation mark.

Anything other than 0 spaces after:

- hyphen in a compound word;
- dash (--);
- diagonal.

Count only 1 error per punctuation mark even if it had two spacing errors.

Paragraphs not indented:
- 5 spaces for timing;
- 5, 10, or 15 spaces for the manuscript.

SPACING EXCEPTION: On manuscripts with right justification, the spacing may be irregular.

OTHER ERRORS:

When typing a manuscript, a student can make errors other than typographical, such as incorrect format. If an error of this kind is consistently made throughout the manuscript, count it as only 1 error.

The following are considered as errors:

Margins: Not 72-stroke line.

Right justification:
Manuscript 1: not right justified;
Manuscript 2: not right justified;
Manuscript 3: right justified.

Heading:
Title: Not on line 12, 13, or 14.
Not centered on page;
Not typed in all capitals;
Underlined.
Not one blank line between title and byline or title and sub-title or subtitle and byline.
Byline and/or SubTitle: Not centered on page;
Typed in all capitals;
Each word not capitalized (except for word **for** in Manuscript #3;
Not on one line.
Not two blank lines after last line in heading (byline, or subtitle).

Body of Manuscript:
Paragraphs not double spaced;
Not 1 blank line between paragraphs;
Pressed Return incorrectly:
- At end of line (thus, not using word wraparound).
- To start a new paragraph at incorrect place.
Bold used where it was not indicated.

Sideheading:
Not typed at the Left Margin;
Not typed in all capitals;
Not 2 blank lines before;
Not 1 blank line after;

Any characters after the sideheading;
The sideheading underlined.

Paragraph Heading:
Not indented;
Typed in all capitals;
Anything other than 1 blank line before;
Anything other than 1 blank line after;
On a line by itself (ie, it should be followed by text);
Not underlined.

Deletion of Title, Sub-Title, Byline, Sideheading or Paragraph Heading:
Each heading deleted will be counted as one error. In addition, other errors associated with that heading will be counted according to how the student typed that particular heading on other manuscripts.

For example, if a student left out a title on one manuscript, and on the other manuscripts had typed in the title but didn't type it in all capitals nor leave one blank line after it, the student would be charged with 3 errors (omitting title; not all caps; not one blank line after title).

If the student did not type that particular heading on any other manuscript, then he/she will be counted with all the errors associated with that heading.

Body of Manuscript #3:
TV not changed to **television.**
The sentence: **Many people today have their own computer**
- Not moved to second sentence of manuscript;
- Moved but not deleted from original position.

Third sentence of first paragraph:
- **In 1975** not moved to beginning of sentence;
- Not indented 5 strokes in from Left Margin;
- Not indented 5 strokes in from Right Margin;
- Not single spaced.

Extra not changed to **Additional.**
< not changed to **less than.**
All money amounts not in bold.
The asterisk after the money amounts not superscripted.
***In Canadian dollars:**
- Not 2 blank lines before;
- Not right justified.