ANALYSIS OF ERRORS LOCATED BY BUSINESS STUDENTS
IN HARDCOPY VERSUS SOFTCOPY DOCUMENTS

by

Karen Kuhla Seibel

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APPROVED:

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B. J. Schmidt, Chair

_____   _____
J. D. Oliver   J. R. Stewart

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Committee Chair: B. June Schmidt
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(ABSTRACT)

The problem of this study was to examine errors located by subjects proofreading hardcopy versus softcopy business documents. Hardcopy refers to a business document typed or printed on paper; softcopy refers to a business document displayed on a computer screen. Data were obtained by 61 Southwest Virginia high school business students completing a background information sheet and proofreading the same three documents--a letter, a report, and a memo--on both hardcopy and softcopy media; for each media, the students proofread each document for 15 to 20 minutes over a 1-hour period. The number and types of errors found, the number of times each document was proofread, and personal characteristics of the subjects were analyzed.

The following outcomes are based on the results of the study: (a) subjects located the same number of errors when proofreading from hardcopy and softcopy media; (b) subjects located one to two more errors in the letters and reports than in the memos; (c) the medium was not related to the specific types of errors found; (d) subjects who proofread

a document five times located one to two more errors than those who proofread fewer times; (e) subjects with 0 to 2 years of computer experience located one more error than those with more experience.

The two main conclusions of the study were: (a) students need not print hardcopies of documents in an attempt to locate more errors than in softcopy documents; and (b) teachers should be aware that students are more likely to locate some types of errors than others.

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CHAPTER 1

INTRODUCTION

A crucial function of any office is providing
information for executives, managers, professionals,
clients, and administrative support workers. All business
information is processed through a five-stage cycle of
input, processing, output, distribution and communication,
and storage and retrieval. The more efficiently and
accurately this information is processed, the greater
chance a business has to compete successfully in local,
national, and world economies.

To help increase efficiency, productivity, and quality
in processing of information in the office, employers have
implemented computer-based technology. Even with this
advanced technology, however, tasks exist that the computer
cannot adequately perform. Electronic dictionaries, for
example, only highlight certain potential errors in text;
they will not correct them (Satterwhite, 1986, p. 25).
Employers must rely on their employees to correct the
errors and to assume responsibility for ensuring the
accuracy of the final document.

Business educators have the responsibility for being
aware of the needs of employers. Therefore, one of their
goals is to train students who are capable of performing in
today's and tomorrow's technological office. This training

includes preparing workers who are capable of proofreading and correcting errors to produce accurate work.

Statement of the Problem

In today's office, both hardcopy and softcopy documents are proofread. Hardcopy refers to a business document typed or printed on paper; softcopy refers to a business document displayed on a computer screen. The problem of this study was to examine errors, both numbers and types, located by subjects when proofreading hardcopy versus softcopy business documents. It was addressed through the following research questions:

1. Does a difference exist in the number of errors subjects locate when proofreading from hardcopy versus softcopy media for different types of business documents?

2. Does a difference exist in the number of errors subjects locate according to type of error when proofreading from hardcopy versus softcopy media for different types of business documents?

3. Do personal characteristics of the subjects relate to the ability to locate errors when proofreading from hardcopy versus softcopy media for different types of business documents?

Purpose of the Study

Study outcomes will provide information for business educators as they pursue goals outlined in a Statement by the Policies Commission for Business and Economic

Education ("This We Believe," 1986, p. 14). The statement indicates that business educators have a responsibility to move in new directions including: (a) preparing students and retraining workers for changing work requirements, (b) incorporating new course content, and (c) creating new strategies for teaching traditional courses. Based on outcomes of this study, teachers will have information available to guide them in new directions regarding the proofreading of hardcopy and softcopy documents.

The Policies Commission Statement indicates that the future business education curriculum must: (a) incorporate concepts that teach workers to function effectively in a high-tech environment, (b) reflect the findings and implications of relevant research, and (c) refine traditional communication skills of writing, speaking, listening, and reading ("This We Believe," p. 14). Empirical evidence needed to help develop the business education curriculum, evidence that may reflect the need to increase students' awareness, knowledge, and performance level related to proofreading in today's and tomorrow's office, will be examined.

Need for the Study

To compete in local, national, and world economies, corporations must produce quality goods and services. At the same time, companies are attempting to cut operating costs and increase productivity and efficiency without

sacrificing quality. "The cost of operations in today's office is rising faster than any other segment of business--about 12-15% a year and these costs will double over the next six years" (Rubin, 1981, p. 12). Paradoxically, "there has not been a comparable increase in office productivity" (Rubin, p. 12). There has been no significant rise in office productivity since the 1950s; in fact, office productivity has only increased by 4%. Office efficiency ranges from 40-60%, a figure that business executives want to change (Harder, 1986, p. 9).

This is an age of information explosion, an age where the amount of information becoming available is doubling every 10 years (Satterwhite, 1986, p. 25). In addition, office technology is progressing rapidly. There have been many technological advances incorporated in each step of the information processing cycle, i.e., facsimiles, laser printers, and electronic mail. These advances have streamlined the flow of work and provided better ways to get it done ("The Office Technology," 1983, p. 4). The combination of increased information and advanced technology results in more information getting processed "easier, faster, and more efficiently" (Yacht, 1983, p. 13). As a result, many more important decisions are being made more quickly. Accuracy in the information processing cycle is essential. One key to accuracy in the information processing cycle is accurate proofreading.

As mentioned, proofreading is a vital skill in the office. Paradoxically, one of the leading complaints of employers is inaccuracy among typists. The real need, as has been pointed out in studies conducted by Erickson, Ryan, and Wise, is for accurate proofreading (West, 1983, p. 283). Typically, proofreaders tend to catch only 60-75% of errors in one reading (West, pp. 284-285).

There is not only a lack of office workers with accurate information processing skills, such as proofreading; there is also an overall shortage of administrative support workers. For example, in 1981 a projected 295,000 openings for secretarial jobs were reported, 20% of which remained unfilled due to an absence of qualified candidates (Howard, 1981, p. 11).

Equipment companies have responded to employers complaints about inaccuracies in proofreading by inventing high-tech equipment to compensate for the inadequacies of administrative support personnel (Howard, p. 11). Most equipment, however, only detects selected errors. It does not detect all errors nor correct the errors. The operator must know what the correction should be and then be able to properly make the correction. New information processing equipment has given individuals a false sense of security; they think that the automated equipment will catch all the errors. "The error detecting ability of the typist must be combined with the error-correction capability of the

equipment" (Camp, 1983, p. 16). This study will examine business students' abilities to detect errors. Outcomes of it can lead to an integration of individuals' proofreading skills with the spell-checking abilities of current information processing technologies.

Delimitations

This study was delimited to include only the following:

1. Students who had a minimum of 1 year of classroom experience on electric typewriters and 8 months of classroom experience on microcomputers with word processors.

2. Students enrolled in Secretarial Administration I, Secretarial Administration II, or Office Specialist II at Richlands High School, Richlands, Virginia and Tazewell High School, Tazewell, Virginia during the 1987-88 school year.

3. Students in Grades 11 and 12.

4. Five types of errors: (a) omission, (b) addition, (c) misstroke, (d) transposition, and (e) substitution.

5. For each media, hardcopy and softcopy, the students proofread three documents for 15 to 20 minutes each over a 1-hour period.

Limitations

This study was limited by the following:

1. The degree to which the sample used was representative of students from a rural, Southwest Virginia area.

Definition of Terms

The following terms are defined as they apply to this study:

Proofreading is the process of examining hardcopy and softcopy business documents without having a source document and identifying keyboarding errors that keep the finished document from being correct.

Hardcopy is a business document typed or printed on paper.

Softcopy is a business document displayed on a computer screen.

Business documents are reports, letters, and memos used in business transactions.

Keyboarding errors are typographical errors including omissions, additions, misstrokes, transpositions, and substitutions occurring when an operator sees the correct form in the original copy but keys it incorrectly.

Personal characteristics are variables that may influence an individual's proofreading performance, including number of times an individual proofreads a document, years of computer experience, formal proofreading

instruction, wearing corrective lenses while proofreading, and a glare on the computer screen while an individual is proofreading.

Formal proofreading instruction is classroom or on-the-job training in proofreading techniques.

CHAPTER 2

REVIEW OF RELATED LITERATURE

This research was completed to determine whether any difference exists in the number and types of errors individuals can locate when proofreading from hardcopy versus softcopy business documents. The literature review will focus on the following areas: (a) the importance of quality to office productivity, (b) the role of proofreading in an automated office, (c) the importance of accurate proofreading, (d) perceptual factors affecting proofreading, (e) variables affecting proofreading performance, and (f) errors made by typists and undetected by proofreaders.

The Importance of Quality to Office Productivity

"The major problem of business in the 1980s is to overcome the rising costs of office operations by improving office productivity" (Rubin, 1981, p. 31). An increase in production, however, is meaningless without quality in the goods being produced. To ensure accuracy, and therefore quality, it is imperative that an employer's office workers be competent in the skill of proofreading.

Top-quality written communication is also an important factor in a company's profitability. Mascolini (1988) conducted a study in which corporations with proven records of excellence in communications were compared in

profitability with others in their industry. "Forty-nine publicly owned companies that have won two or more communications awards composed the sample studied. Their records of profitability were compared with those of nonaward-winning companies in the same industries" (p. 36). The industries represented in the study were mining and manufacturing, services, and utilities. The results showed that 33 of the 49 companies judged outstanding in communication had performance ratings above those of their industries (Mascolini, p. 38).

A lack of quality in correspondence has a negative impact on an organization's effectiveness. Written correspondence is often the initial contact, and maybe the only contact, that an individual has with a company or organization. Therefore, "a well written letter can be a goodwill ambassador" (Camp, 1979, p. 26). A letter containing errors, however, can have the opposite effect by leaving the reader with negative impressions about the organization. When customers, clients, or readers detect an error, they tend to pay more attention to the error than to the message (Satterwhite, 1986, p. 26). The results of inaccurate correspondence may be that: (a) a client believes that an organization that is careless about its correspondence might also be careless about handling important affairs (Camp, 1979, p. 26), (b) there are negative effects on the company's overall credibility

(Satterwhite, 1986, p. 26), and (c) there is an ensuing high cost to employers in terms of embarrassment and potential misunderstandings (Camp, 1983, p. 16).

In addition to the potential damages to a company's reputation, errors in correspondence may also cost the company in dollar terms. For example, "an extra digit, undetected, may result in an invoice amount of $13,800 instead of $1,380" (Camp, 1979, p. 26).

The Role of Proofreading in an Automated Office

Several concerns support the continuing need for proofreading skills in the office of the future. Technological advances in information processing have not replaced the need for workers to have spelling and proofreading skills. The technology, in fact, often results in office workers having a false sense of security about the accuracy of documents processed. The "automated office demands certain word and data processing skills, namely the creation, editing, manipulation, storage, and retrieval of words and data" (Peterson, 1982, p. 22). Advanced technological equipment has been incorporated into the information processing cycle of automated offices. This equipment will not, however, produce perfect communications. "Many companies that have invested heavily in equipment to increase the productivity of their office have been disappointed with the results" (Rubin, 1981,

p. 12). After investigation into a major New York City
bank's lack of increase in office productivity,

> . . . a consultant learned that almost 90% of the
> material coming from the word processing center had
> to be retyped. The problem was not that the equipment
> didn't do the job it was supposed to do, but rather
> that the people using the equipment lacked the
> necessary skills to utilize it efficiently (Rubin,
> p. 12).

Most word processing spell checking features cannot
recognize all types of errors (Camp, 1983, p. 16). Office
workers often fail to realize this and are lulled into a
false sense of security about computers being able to
correct errors. A spell checker may detect misspelled
words, however, incorrectly used words (Camp, p. 16),
"hidden meanings, double meanings, and incorrect grammar
can still be detected only by a human being" (Goodrich,
1981, p. 10).

The fact that electronic office equipment will not
replace good proofreading skills (Peterson, 1982, p. 22)
means that today's and tomorrow's office employees need
language arts skills in order to correct errors that the
computer highlights (Satterwhite, 1986, p. 25). Students
cannot accurately proofread a paper if they do not
recognize errors. A solid language arts base, including
knowing the correct spelling of words and correct

grammatical usage, will help students locate errors (Frankhouser, 1979, p. 315). Substantiating the need for office workers to have language arts skills so they can correct errors that are, and are not, identified by the computer, is a leading complaint of employers--the inability of office workers to find and correct mistakes (Anderson, 1976, p. 60; West, 1983, p. 284).

Another concern supporting the need for accuracy in the automated office revolves around the increase in the use of electronic data processing equipment, which magnifies the effect of errors (Wong, 1975, p. 17). In today's offices, networks of systems are held together by rapid transmission of communication, immediate responses, and the instant duplication of documents (Goodrich, 1981, p. 8). Advanced technology has led to an increase in the speed at which messages are sent, received, read, and acted upon; however, it also has the potential for multiplying the cost of errors that result from quick decisions and actions.

Several technical trends exist that have led to an increased demand for accuracy in business communications. First, since "word processors will automatically type whatever has been keyboarded, it is extremely important that careful attention be placed on proofreading skills" (Yacht, 1983, p. 13). Second, through the use of electronic mail and facsimile machines, "a written message

may now be received halfway around the world in less than
30 seconds" (Goodrich, 1981, p. 9). An immediate response
to the message, as a result of the speed of transmitting
the response, is feasible. However, acting immediately
upon inaccurate information can waste both time and money
(Goodrich, p. 9). Third, with the advent of word
processing, an increase in the volume of communication has
resulted. When combined with the possibility of
individuals acting upon inaccurate information, the result
can be misunderstood or misinterpreted information
(Goodrich, p. 9). Misinformation can seriously damage a
firm's reputation for providing quality goods and services.
Fourth, "the convenience and low cost of making copies have
contributed to a paperwork explosion" (Camp, 1983, p. 16).
Intelligent copiers are characterized by high speed
operations; "their performance is measured in pages per
minute rather than the usual characters per second or lines
per minute" (Goodrich, 1981, p. 9). One error, then, can
suddenly be multiplied into thousands of errors. For
example, a report with one error that is copied 2,000 times
becomes 2,000 errors.

The Importance of Accurate Proofreading

"The office of the future will demand stiff
competition for the best positions" (Camp, 1983, p. 16).
Once students learn to proofread efficiently, they will
have the professional edge they need in order to be able to

attain and keep the position they desire (Camp, p. 16). They will also be better "prepared to meet the challenges and demands of the modern office" (Camp, 1979, p. 27).

"With recent changes in the office environment, the roles and responsibilities of office workers have expanded to accommodate the capabilities of office equipment" ("The Office Technology," 1983, p. 4). Some students will work with typewriters, some with microcomputers, and some with both. The ability to adapt to different equipment is a necessity in today's world (Hinson & Dickey, 1984, p. 12). Fruehling and Weaver (1986) clarified the changing responsibilities of workers by comparing an actual job description outlining the functions of a traditional secretary to one of a state-of-the-art secretary. One of their findings was that "students must learn to do things in both the manual and the electronic way" (Fruehling & Weaver, p. 10). With regard to the need for proofreading skills for both traditional and state-of-the-art office workers, the job descriptions were outlined as follows. In the traditional job description, one task was to "format, type and proof documents" (Fruehling & Weaver, p. 11). The state-of-the-art secretary was required to "format, enter, and proof documents" (Fruehling & Weaver, p. 12). Proofreading skills, then, are needed in both manual and automated information processing cycles.

A major function of an office worker in both the traditional and electronic office is to "increase the efficiency of document preparation and information flow" (Fruehling & Weaver, p. 11). Meanwhile, the "basic purpose of business communication is the same as it has always been--to get an idea from the mind of the sender to the mind of the receiver" (Satterwhite, 1986, p. 26). One goal of the office worker, then, is to expedite information through the information processing cycle efficiently and accurately. Therefore, the office worker must check for inconsistencies and inaccuracies in the processing stage of the cycle so that the information that will be sent to those receiving the document will be finalized ("The Office Technology," 1983, p. 5). The underlying theme is that the office worker must assume the responsibility for the accuracy and quality of the final products being returned to executives for signing and disposition (Camp, 1979, p. 26). If the office worker does not bear the responsibility for proofreading accurately, the "burden of proofreading reverts to the person who originated the correspondence--the very person we are supposed to help be more productive" (Rubin, 1981, p. 31).

Management people look for proofreading skills when hiring workers because office workers are increasingly involved with some kind of error detection or verification (Camp, 1979, p. 26). Once on the job, basic communication

skills, such as the ability to write and speak, are necessary for an individual to be successful in the business world (Satterwhite, 1986, p. 25). In a 1986 study of 35 firms with 700,000 employees, various communication skills were rated by office supervisors. An individual's ability to communicate in writing when preparing or originating communication was rated by 43% of the supervisors as being useful and by 21% of the supervisors as being very important or important (Kaisershot, 1987, p. 15). When asked about the importance of communication skills, abilities, and knowledge for overall communication effectiveness, proofreading received a score of 3.68 out of 5.00 (Kaisershot, p. 16). In two 1984 and 1986 studies, keyboarding skills needed by managers were identified and compared. In 1984, one of the top five keyboarding skills most used on the job by managers was the skill of proofreading; it was ranked in fourth place by 89 of 173 managers or 63% of the total (Sox, 1988, p. 30). In 1986, the same skill fell slightly in importance. It was ranked seventh place by 54 of 121 managers or 59% (Sox, p. 30).

Communication skills have been identified as being important to the success of an office worker on the job. However, business supervisors and managers indicate that these same basic communication skills, including being able to correct errors, are near the top of their lists of

employee skills needing the most improvement (Satterwhite,
1986, p. 25).

Perceptual Factors Affecting Proofreading

Students may know how to "spell a word, but this
knowledge doesn't prevent the reader [student] from
overlooking an error within the same word during
proofreading" (Wong, 1975, p. 16). There are several
reasons for this occurrence. "The process of reading is
highly complex . . . . In proofreading, another
complicating factor is added--that of error detection"
(Wong, 1973, p. 122). "Research evidence indicates that
the perceptual factor in reading allows a reader to
continue along a line of print when his need for
comprehension is satisfied, in spite of the fact that
errors, gross or slight, may be present" (Wong, p. 122).

The procedure followed by our visual system in reading
a line of print is described as follows:

Eyes are the receptors and the channel by which

the brain receives information. Through years of

practice, beginning at the elementary grades, our

eyes have been trained to follow continuing cycles of

fixation, saccade, fixation, saccade along a line of

print. During a fixation, our eyes focus on a small

area of space; groups of abstract symbols (letters)

are transferred to the brain, where they are absorbed

and reconstituted into meaningful experience . . . .

At the completion of a fixation, the eyes advance to the next group of words through the movement called a saccade . . . . Throughout this process, the reader is unconscious of, and cannot control, the movements of the muscles of his visual system. One is typically unaware of the number of words perceived during a fixation and of the speed advance during a saccade.

The complexity of proofreading lies in what occurs during the fixation phase when the symbols are being processed by the brain. As the eyes focus on the words, the brain is testing alternative hypotheses about the meaning of the symbols. Once the need for comprehension is satisfied by an acceptable solution, a saccade begins and the reader proceeds to the next fixation even though errors may be present.

A reader finds it extremely difficult to alter or adjust his reading pattern during proofreading. Even when one accepts the instruction to read letter-by-letter, one finds oneself unconsciously reverting to word-group reading through force of habit. Lasky [1960] has suggested that proofreading requires a larger number of fixations than any other type of vision, but even if a reader desired to advance or impede his rate and number of fixations and saccades,

he finds that he cannot control his muscles. (Wong, 1975, pp. 16-17)

This process suggests that individuals may have difficulty proofreading because they do not see the error, not because they do not know what the correction should be.

Variables Affecting Proofreading Performance

Several variables have the potential for affecting a student's proofreading performance. They include formal proofreading instruction, proofreading procedures, the use of references, years of computer experience, and negative factors related to consequences associated with using computer terminals.

"In order to succeed in the electronic office, today's typing students must master both typing and nontyping competencies" (Ober, 1984, p. 10). The skill of proofreading is one of the typing competencies (Ober, p. 10). Many students have difficulty producing accurate communications in that they fail to detect errors. They have not been equipped to locate errors, rather they are just told to "catch all the errors." Little has been done to actually teach the student anything about proofreading (Peterson & Staples, 1969, p. 9). Further, "many students believe when they leave school they will enter an electronic world where little reading and writing will be required of them" (Satterwhite, 1986, p. 25). Today's technology will not make communication skills, such as

proofreading, obsolete. Instead, students need "step-by-step directions for proofreading if they are to learn to do so efficiently" (Ober, 1984, p. 10). If educators wish to help eliminate proofreading deficiencies and help students qualify for jobs, they must teach students how to proofread (Howard, 1981, p. 11). Business educators have the responsibility to include language arts skills, including that of proofreading, in every class (Satterwhite, 1986, p. 25). Proofreading should be treated as a skill objective until proficiency is developed (Wong, 1973, p. 123). Research information regarding the number and types of errors on which to build skill instruction is not yet available.

Even though most literature points to the need for students to be taught proofreading techniques in order to become efficient and effective at this important skill, West has found some evidence that this instruction may not be effective. West (1983) reports that "for students of heterogeneous ability, deliberate instruction in proofreading exercises has no apparent effect on proofreading proficiency" (p. 287). He reasons that the lack of effect on proofreading scores may be "because, in reading for comprehension, the eyes move ahead when meaning has been grasped, failing to perceive the details within words" (West, p. 287).

Another factor, associated with proofreading performance, is how many times an individual reads through a document. Camp (1979), Dewar and Daniels (1987), Seitz (1986), Sobolik (1975), and West (1983) all cite that the minimum requirement is for an individual to proofread any piece of work at least two times. The material should be read one time for typographical and spelling errors. Another time, the material should be verified for content errors.

Use of references may also affect a proofreader's performance. Camp writes that "reference books are essential for consistent accuracy and proofreading" (Camp, 1983, p. 16). Students should be required to have and use good reference books, grammar books, thesauruses, dictionaries, and secretarial reference manuals (Howard, 1981, p. 11). Office workers should also avail themselves of reference books when proofreading, because "employers do not say `if you don't know something, don't look it up'" (Camp, 1979, p. 27).

When identifying whether there is any difference in a proofreader's performance when proofreading from hardcopy or softcopy documents, another factor must be considered. Proofreading proficiency on softcopy documents may be related to the number of years that an individual has worked with computers. No literature addressing this factor exists. However, if an individual has computer

experience, he or she may have become accustomed to dealing with problems that arise when a computer terminal is used, i.e., controlling for glare or adjusting a chair for comfort. An individual without computer experience may not deal as easily with these same problems and may, in turn, have poorer proofreading performance levels.

Several factors associated with using computer terminals exist that can affect a proofreader's performance. These include an operator's health, both mental and physical, when working with a video display terminal. One factor is "computer phobia." "The fear of computer terminals or micros exists for a large group of people. This fear is inhibiting the learning processes required for many jobs, as the worker is too preoccupied about pressing a wrong button" (Swanson, 1986, p. 17). If individuals who work with a computer do not have this fear, they can spend more time learning how to use the machine properly without worrying about what they might do wrong.

Another factor that might influence a proofreader's performance is the wearing of corrective lenses.

Most lenses have a focal unit of an 18-inch distance in reading, the standard distance between eye and book page. The video display terminal is designed for viewing distance of 27 inches from the eye to the visual display, however (Fredrickson, 1982, p. 245).

Individuals wearing corrective lenses may have to tilt their heads back and forth from the keyboard to the screen in order to bring the lens into proper position for focusing; this can lead to strain and fatigue, which may result in decreased productivity (Fredrickson, p. 245).

A third factor that may significantly affect a proofreader's performance relates to comfort. Findings from two well-publicized Louis Harris surveys of white-collar workers indicate that comfort and productivity are intertwined (Chol, 1985, p. 17). Seating is one of the most important components affecting employee comfort. In one Harris survey, 54% of office workers declared that a comfortable chair is a major factor influencing their productivity (Chol, p. 18). In a 1982 study, office employees were asked what workstation characteristics were of greatest importance to them; their answers included comfort and the ability to adjust the writing surface (Galitz, 1984, p. 181). Attention to the comfort factor is important to individuals spending any amount of time using a computer terminal; a poorly designed chair can create physical stress and can lead to backaches, neck pains, headaches (O'Connor & Regan, 1986, p. 22), and decreased productivity.

One of the main elements of workstation design and comfort and, therefore, a proofreader's performance is lighting (O'Connor & Regan, p. 22). "Glare on screens

caused by reflections from windows, artificial lighting, and shiny surfaces causes operator eyestrain and often makes reading material on the screen difficult (Dolecheck, 1984, p. 34). The physical discomfort felt can "severely curtail the effectiveness of office workers" (Chol, 1985, p. 20) and interfere with productivity (Dolecheck, 1984, p. 35).

A final factor that may affect a proofreader's performance while working at a computer terminal relates to the monitor colors straining the reader's eyes, and, consequently, reducing productivity levels. "Much debate still rages about screen and character color; as yet, research provides no concrete answers. Many authorities consider light characters on a dark screen better than dark on light" (Dolecheck, 1984, p. 34).

Errors Made by Typists and Undetected by Proofreaders

Various types of errors are made by writers and keyboarding specialists. For a study conducted by Connix, the following errors were found to occur the most frequently: (a) substitution errors, (b) transposition of letters, (c) omitted letters, (d) insertion of stray letters, (e) extra spaces between words, and (f) punctuation spacing (Hilgedick, 1984, p. 14). Transposition errors accounted for 33% of other errors not classified as substitution errors; omitted letters accounted for 27%; insertion of stray letters accounted for

19%; extra spaces between words accounted for 17%; and
punctuation spacing, either an extra space before or no
space following, accounted for 4% (Hilgedick, p. 16). A
relationship exists between this study and a study
conducted at the University of Missouri-Columbia that
examined the types of errors made by advanced secondary and
collegiate level typing students. For the latter study,
16% of the errors made by typists were the result of
striking one letter for the other in the following order:
e for i, i for e, r for e, e for r, a for e, e for a, a for
s, s for a, m for n, n for m, i for o, and o for i
(Hilgedick, p. 14). Dewar and Daniels (1987) identified
some other basic types of errors made by typists. The
types of errors included: (a) keyboarding errors, such as
omissions, additions, misstrokes, enumerations,
transpositions, and abbreviations; (b) word division
errors; (c) errors in expression of numbers; (d) errors in
format; (e) grammatical errors; (f) confusing words;
(g) punctuation errors; (h) capitalization errors; and
(i) content errors (pp. 3-200).

Several types of errors are most commonly undetected
by proofreaders. "When students are knowledgeable of the
types of errors they should be looking for in checking
their work, they are better prepared to do a responsible
proofreading job" (Shell, 1982, p. 304). Some of these
errors overlap the types of errors made by typists. Shell

identified five categories of errors: (a) typing errors, including typographical errors, transpositions, additions, omissions, strikeovers, raised capitals, and spacing errors; (b) English errors, including spelling, words frequently confused, capitalization, punctuation, errors in forming plurals, errors in forming possessives, word division, and errors in agreement; (c) content errors, including names, facts, inconsistencies, addresses, state abbreviations, zip codes, dollar amounts, dates, telephone numbers, and other numbers; (d) form errors, including letter style, punctuation style, paragraph indentions, positioning of letter parts, headings, spacing, and margins; and (e) appearance errors, including corrections, smudges, typescript, vertical placement, and margins (Shell, pp. 305-307). Houser (1977) identified the errors most commonly overlooked by proofreaders as being: (a) transpositions, (b) similar words, and (c) figures and symbols (p. 263). Peterson and Staples (1969) identified 10 classifications of errors that are the most likely to remain undetected. These errors are: (a) in headings or subheadings, (b) near beginnings or at the ends of lines, (c) toward the bottom of the page, (d) in long words that occur rather frequently, (e) additions or omissions, (f) letter transpositions, (g) in captions or footnotes, (h) in proper nouns, (i) in vertical enumerations, and (j) in number combinations (pp. 9-10).

Summary

Literature directly relating to proofreading on hardcopy versus softcopy documents is limited. This review, however, does provide substantial indication of a need, based on business employers', employees', educators', and students' concerns, for research comparing proofreading skills of individuals using different media.

CHAPTER 3

PROCEDURES

The purpose of this study was to determine if a difference exists in errors found when proofreading hardcopy versus softcopy business documents. Specifically, three research questions were answered:

1. Does a difference exist in the number of errors subjects locate when proofreading from hardcopy versus softcopy media for different types of business documents?

2. Does a difference exist in the number of errors subjects locate according to type of error when proofreading from hardcopy versus softcopy media for different types of business documents?

3. Do personal characteristics of the subjects relate to the ability to locate errors when proofreading from hardcopy versus softcopy media for different types of business documents?

Procedures followed in the conduct of the study are discussed, including: (a) development of materials, (b) selection of subjects, (c) procedures used to prepare for and conduct the study, (d) procedures used to administer the pilot test, (e) changes based on the pilot test, (f) data collection, and (g) statistical analysis of the data.

Development of Materials

Development of the materials included procedures followed in preparing: (a) documents, (b) instruction sheets, (c) identification numbering system, (d) background information sheets, (e) answer sheets, and (f) error analysis sheets.

Documents

In preparing the documents used in the study, several steps were followed. First, documents that are representative of those used in industry were chosen. Letters, memos, and reports have been found to be the most frequently typed documents in industry (Ober, 1982, p. 17; "The Office Technology," 1983, p. 4); therefore, they were selected as the documents used in the study. Each participant proofread each of these three documents on both hardcopy and softcopy media, for a total of six documents. Data collected from the proofreading of the hardcopy and softcopy documents were used to answer the first two research questions and part of the third research question, the part that dealt with determining if the number of times an individual proofreads a document makes a difference in the number of errors the individual finds.

The second step involved deciding what specific types of errors to include in the study. From the literature review (Dewar & Daniels, 1987; Hilgedick, 1984; Houser, 1977; Peterson & Staples, 1969; Shell, 1982), a list of

errors for possible use in this study was compiled. Five categories of 15 different types of errors were selected, each representing an error that could be detected through proofreading the copy only--proofreading without having a source document available. The five categories of errors included in this study were: (a) omissions, (b) additions, (c) misstrokes, (d) transpositions, and (e) substitutions. Appendix A contains definitions and examples of each type of error.

The third step in preparing the documents was choosing the appropriate ones. Documents that are used in the high school setting were selected to ensure that the participants would proofread material they would normally use in business education classes. A memorandum and letter were identified from Programmed Proofreading (Dewar & Daniels, 1987); a report was chosen from Gregg Typing I: Keyboarding and Processing Documents (Lloyd, Winger, Johnson, Morrison, & Hall, 1987). The students proofread the same documents, which were typical of those used in business, on both the hardcopy and softcopy media. To use these documents without infringing on copyright laws, the researcher obtained the permission of the two publishers of the texts in which the documents appeared, South-Western Publishing Company and the Gregg Division of McGraw-Hill Publishing Company. Evidence of permission obtained can be found in Appendices B and C.

The fourth step in preparing the documents involved deciding specifically what errors to include in each document. The errors were examples developed from the list of 15 types of errors selected for inclusion in the study. The actual errors incorporated into each document are provided in Appendices D, E, and F.

This study focused on keyboarding errors only, not content errors. The literature reviewed (Camp, 1979; Dewar & Daniels, 1987; Seitz, 1986; Sobolik, 1975; West, 1983) suggests that an individual needs to proofread a document only once for keyboarding errors. However, little research exists of whether or not proofreading more times will increase the number of keyboarding errors found by the proofreader. For Wong's study (1971), errors found by high school students "averaged 61% in one reading of the copy, 70% in a second reading, and no better than that in a third reading" (West, 1983, p. 285). Thus, the line "The number of time(s) I read through this document was _____." appeared on each document so that how many times each subject read through each document could be recorded as the documents were proofread.

Instruction Sheets

Different instruction sheets were prepared for the proofreading of hardcopy and softcopy documents. Information and steps that were similar were included for both types of documents. For instance, students

proofreading either hardcopy or softcopy documents were required to do so without the help of others, but they were allowed to access reference books. However, differences in the procedures did arise due to the nature of the hardcopy and the softcopy documents. For example, the subjects proofreading softcopy documents keyed the corrections into the documents, while the subjects proofreading hardcopy documents circled the errors and wrote the corrections on separate sheets of paper. These differences were addressed in the respective instruction sheets. The instruction sheets for proofreading softcopy and hardcopy documents are provided in Appendices G and H.

Identification Numbering System

To aid the researcher in disseminating the material during the testing, preparing results, and assuring anonymity of the subjects when reporting the results, the researcher assigned identification numbers to the subjects. The researcher placed each subject's number on the upper right-hand corner of his or her background information sheet prior to the documents being proofread by the subjects.

Each subject was asked to place his or her number on each document proofread. The students also placed either an "h" or an "s" beside their identification numbers to help the researcher determine on which medium the

particular document was proofread when the data from the documents were processed.

Background Information Sheet

A background information sheet was used to collect personal information that was needed to answer the third research question, "Do personal characteristics of the subjects relate to the ability to locate errors when proofreading from hardcopy versus softcopy media for different types of business documents?" Based on a review of the literature concerning variables that may affect a proofreader's performance level (Chol, 1985; Dolecheck, 1984; Fredrickson, 1982; Howard, 1981; O'Connor & Regan, 1986; Ober, 1984; Satterwhite, 1986; Swanson, 1986), the researcher included the following questions on the background information sheet: (a) How many years have you had of computer experience? (b) Have you had formal proofreading instruction, either in school or on the job? (c) Do you wear corrective lenses, either contact lenses or glasses, when proofreading? (d) Do you enjoy working with the computer? (e) Are you physically comfortable while you are working with the computer? (f) When you work with the computer, is there a glare on your computer? and (g) When you work with the computer, do the colors on the computer screen bother your eyes?

Question 1 asks about the number of years the individual had worked with computers. Response options for

it were divided into 1 year increments, i.e., 0 to 1 year, 1 to 2 years, with the exception of the last option which was 6 or more years. For Question 2, the subjects based their answers on past experiences; therefore, only "Yes" or "No" responses were required. "Yes", "No", and "Sometimes" were response options for Questions 3 through 7, because these answers were based on the conditions at the time the subjects proofread the documents. A copy of the background information sheet appears in Appendix I.

Answer Sheets

Students proofreading hardcopy documents were required to circle any errors in the documents. Once they had circled all the errors they could find, they recorded corrections for the errors on an answer sheet. The sheet contained three columns, one for each hardcopy document. Subjects recorded only one correction per line on the sheet. A copy of the answer sheet is located in Appendix J.

Error Analysis Sheets

Two error analysis sheets were prepared to aid the researcher in summarizing the data. The first was used to tally the number of errors that the subjects found and properly corrected for each document and the number of times the subjects proofread each document. The second listed the 15 types of errors and was used to tally whether a specific error was found and if it was properly

corrected. Both error analysis sheets contained spaces for recording the identification numbers of all subjects and for identifying the type of document being analyzed. Copies of the error analysis sheets appear in Appendices K and L.

<div align="center">Selection of Subjects</div>

Characteristics

The requirements for choosing subjects included proximity of their high schools to Richlands, Virginia, and the subjects being enrolled in a business class that included word processing assignments. Teachers at two Southwest Virginia high schools agreed to have their students participate in the study. Business classes offered at the two schools, Richlands High School and Tazewell High School, that fit the study requirements were Secretarial Administration I, Secretarial Administration II, and Office Specialist II. Descriptions of the classes appear in Appendix M. Four classes were identified at Richlands High School: two Secretarial Administration I, one Secretarial Administration II, and one Office Specialist II. All of these classes were block classes and, therefore, met for two consecutive periods. One of the Richlands High School Secretarial Administration I classes was used to pilot test the study documents and procedures. One class from Tazewell High School, an Office Specialist II class, also met the study requirements. This

class was not a block class and was, consequently, one period in length. Table 1 summarizes the characteristics of the potential subjects involved in the study, including those involved in the pilot test.

Permission for subject participation in the study was obtained from the teachers whose classes were to be involved in the study; at Richlands High School, oral permission was also needed and obtained from the principal. When the researcher obtained permission to conduct the study from the teachers, they also agreed to provide computers and printers needed to complete the study.

Procedures Used to Prepare for and Conduct the Study

The discussion in this section is divided as follows: (a) design of the study, (b) random assignment of subjects, (c) preparation of documents and disks, (d) steps followed in conducting the study, and (e) scoring methods.

Design of the Study

The study took place during the Spring of 1987 and included two testing days at each school. The testing was conducted during the normal class period(s). During the first testing day, selected subjects proofread hardcopy documents, while others proofread softcopy documents. The subjects proofread the same three documents, but on either hardcopy or softcopy media. On the second testing day, the students switched media. To help ensure that the students would not remember errors in the documents, there was to be

Table 1

Characteristics of Potential Subjects

Characteristic	Frequency
Class	
Junior (pilot)	9
Junior	15
Senior (pilot)	6
Senior	54
Sex	
Male (pilot)	1
Male	1
Female (pilot)	68
Female	14
Business education course	
Richlands H.S.	
Secretarial Administration I (Pilot)	15
Secretarial Administration I	22
Secretarial Administration II	22
Office Specialist II	12
Tazewell H.S.	
Office Specialist II	13

Note. n = 84.

a month between the first and second testing days.

However, because of scheduling conflicts, only 2 weeks

elapsed between the two testing days.

Random Assignment of Subjects

The students were randomly assigned to either hardcopy

or softcopy media first by flipping a coin. If the coin

landed on "tails," the student proofread the softcopy

documents on the first day; if the coin landed on "heads,"

the student proofread the hardcopy documents on the first

testing day. On the second day of testing, the subjects

proofread from the opposite medium.

Preparation of Documents and Disks

For the hardcopy documents, the researcher typed the

three documents, adhering to standard typing rules. The

documents were then duplicated with a fluid duplicator. To

prepare the disks, the researcher obtained a disk from each

student, at the convenience of the teacher prior to each

testing day. The researcher then keyed the documents, and

they were stored onto the students' disks. Back-up copies

of the documents were also prepared for each different word

processing package. The types of word processing packages

used included: WordPerfect, Microsoft Word, and PFS Write.

The computers used included: Tandy 1000's and Macintoshes.

Steps Followed in Conducting the Study

A checklist (Appendix N) of materials to take to each

test site was prepared. On it were: (a) pencils, in case

the students did not have a writing instrument;
(b) dictionaries, in order to ensure that the subjects had
adequate reference manuals; (c) the students' disks and the
researcher's back-up disks; (d) copies of the background
information sheets, instruction sheets, hardcopy documents,
and answer sheets; and (e) printer paper.

Once at the test site and before the class bell, the
researcher readied the computer work stations by placing
paper in the printers. After the bell, the researcher
called the students' names to indicate whether they were to
work at a computer or at a desk. The numbering system
aided in this process. Once the students were seated, the
researcher distributed pencils and dictionaries, if the
students needed these materials.

The researcher then distributed the background
information sheets and directed the students' attention to
their identification number, located in the upper right-
hand corner of the background information sheet. The
students were then instructed to complete the background
information sheet. For those who proofread the hardcopy
documents, they were instructed to answer only the first
three questions. Questions 4 through 7 were answered when
they proofread the softcopy documents. The softcopy
proofreaders answered all of the questions. The students
kept their background information sheet until the

end of the testing period in order to refer to their identification numbers.

While distributing the directions and disks to the softcopy proofreaders, the hardcopy proofreaders were instructed to sit quietly. The softcopy proofreaders were instructed to boot up their word processing packages, but not to start keying anything. Once all the subjects had booted up their computers, the researcher read the softcopy directions aloud as the students read along silently to themselves. The students kept their direction sheets as a reference until the end of the testing period. The researcher asked if the students had any questions regarding the procedures they were to follow. Once questions were resolved, the researcher said, "Begin" and gave the students the name of the first document to be proofread, the report. The researcher also made a note of the starting time.

The researcher then distributed the hardcopy directions and answer sheets. Procedures for reading and asking questions about the direction sheet were similar to those used for softcopy. The first hardcopy document, the report, was then distributed to the students, and they were requested to let the paper remain face down until the "Begin" signal. The researcher noted the beginning time.

At the appropriate finishing times, determined on the basis of the pilot test, the researcher called "Time has

ended for students working on the computer" or "Time has ended for students working at their desks." The documents which had just been proofread were collected. The same procedures, with one exception, were followed for the second document, the memo, and the third document, the letter. The exception was that the direction sheet was not read aloud, but the students could refer to the direction sheet at any time during the testing. After the last document had been proofread and time called, the printouts and documents were collected. Also collected were the: (a) background information sheets, (b) instruction sheets, (c) answer sheets, and (d) dictionaries and pencils. To ensure that the hardcopy proofreaders did not have an unfair advantage by being able to review the softcopy documents before they were tested, the researcher instructed the softcopy proofreaders to delete the documents from their disks.

On the second testing day, the researcher followed the same procedures as outlined above. The only difference was that the students who proofread hardcopy documents on the first testing day proofread softcopy documents, and students who proofread softcopy documents proofread hardcopy documents.

Scoring Methods

When scoring the softcopy documents, the information in Appendices O, P, and Q was used to compare the actual

errors in each document with the errors found by the
students. The researcher circled any errors the student
did not find. The number of errors found was recorded in
red at the bottom of the document. The researcher then
placed a square around the errors that the student found,
but did not properly correct. The number of errors
properly corrected were recorded in blue at the bottom of
the document. The information about the errors located,
along with the number of times the student read through the
document, were recorded on the first error analysis sheet
(Appendix K). For the second error analysis sheet
(Appendix L), the researcher placed a check mark in
appropriate squares if the error was found and properly
corrected; an "x" was placed in the square if the error was
found, but not properly corrected; and the square remained
empty if the error was not found at all. This procedure
was followed for each of the three documents that were
proofread on the softcopy medium.

When scoring the hardcopy documents, the information
in Appendices O, P, and Q was also used. Any errors that
the student did not find were circled, and the total number
of errors found was recorded in red at the bottom of the
document. The researcher then compared the errors found in
a specific document to the answer sheet for a particular
student and placed a square around the answers that were
improperly corrected. The total number of errors that were

properly corrected was recorded in blue at the bottom of the corresponding document. The information about the errors located, along with the number of times the student read through the document was recorded in the first error analysis sheet (Appendix K). The same procedure for completing the second error analysis sheet (Appendix L) as outlined in the procedures for scoring softcopy documents was followed.

Procedures Used to Administer the Pilot Test

The purpose of the pilot test was to determine if the procedures would work in the actual study. The time allowances needed for the actual study were also determined. The pilot group was one of the two Secretarial Administration I classes at Richlands High School. The class had 15 students--1 male, 14 females; and 9 juniors, 6 seniors. The pilot study took place on April 6, 1988. In order to accomplish the objectives of the pilot study, the students were told to ask questions or voice concerns about any problems they might have encountered.

Two modifications were made in the procedures for administering the study. First, the students participated only in the first day's testing; the researcher was not interested in the number of errors located by the pilot subjects, but only if the procedures worked and what the time allowances needed to be. The second modification was necessary to help determine the time allowances. The

documents were given to the subjects one at a time. There was no time limit on how long they had to proofread the documents, or in the case of the softcopy proofreaders, print out the documents. The students marked the beginning and ending times for each document they completed on the upper right-hand corner of the documents. The average length of time it took the pilot group to proofread each of the three documents on the hardcopy and softcopy media was then calculated.

Changes Based on the Pilot Test

The pilot test resulted in four findings. First, the report needed to be changed. The word "programer" can be spelled as either "programmer" or "programer," therefore, it was not used as one of the errors in the actual study. Instead, the word "difference" was changed to "diference" in order to fulfill the need for one type of error, omission of a letter.

Second, the time requirements for proofreading the hardcopy and softcopy documents were determined. The average times for reading the softcopy documents were: report, 14 minutes; memo, 14 minutes; and letter, 15 minutes. The average times for reading the hardcopy documents were as follows: report, 8.1 minutes; memo, 8.1 minutes, and letter, 7.2 minutes. There were only seven individuals proofreading on each type of medium. Therefore, 5 minutes were added to each average time in

order to accommodate the needs of larger groups of subjects. In order to aid the researcher in administering the study, the proofreaders were assigned the same relative amount of time for proofreading each document on each type of medium. The time allotments for the actual study were 20 minutes for proofreading softcopy documents and 15 minutes for proofreading hardcopy documents.

Third, because there was an extra 5 minutes between the softcopy and hardcopy time allotments, the softcopy directions were read aloud first, and the softcopy proofreaders were then told to begin work. During the first 5 minutes of the softcopy proofreaders' time allotment, the researcher distributed and reviewed the hardcopy materials and then told the hardcopy proofreaders to begin. In this manner, the time allowances for both groups of subjects ended at the same time.

Fourth, the researcher needed to explain the terms hardcopy, softcopy, and anonymous to the subjects to increase their understanding of what the study involved.

<div align="center">Data Collection</div>

The procedures developed, including the changes based on the outcomes of the pilot test, were followed in collecting the data. The first day of testing for each class was as follows: (a) Richlands High School-- Secretarial Administration II, April 20, 1987; Secretarial Administration I, April 21, 1987; and Office Specialist II,

April 21, 1987, and (b) Tazewell High School--Office Specialist II, April 27, 1987. The second day of testing was as follows: (a) Richlands High School--Secretarial Administration II, May 11, 1987; Secretarial Administration I, May 12, 1987; and Office Specialist II, May 12, 1987, and (b) Tazewell High School--Office Specialist II, May 13, 1987.

Several problems were encountered by the researcher during the administration of the study. First, several subjects' documents were not on their disks. The researcher had to use the back-up disks to boot the documents to the students' disks.

Second, one printer malfunctioned. Four students were using that same printer, therefore, they were unable to print out their documents during the allotted time. The researcher continued with the study, without collecting their printouts. At the end of the days' testing, the four students' disks were collected and the researcher printed out their documents on a different printer. The researcher then returned the disks to the students the day after the testing.

Third, some subjects had word processing packages with spell checkers. Those subjects wanted to use the spell checkers. The researcher reminded those and subsequent subjects that their error detecting skills were being tested, not those of the spell checkers.

Fourth, the time allowed to proofread the softcopy documents was 60 minutes, plus 5 minutes for the researcher to read the directions aloud to the students. The Tazewell class period was not a block class and, therefore, lasted only 55 minutes. For the subjects to be able to complete the first day of testing in one period, the researcher altered the procedures. Once all students had completed proofreading a softcopy document and had printed out the document, the researcher started the subjects on the next document, even if 20 minutes had not elapsed.

Fifth, each class used several different word processing packages. Therefore, when the researcher worked with unfamiliar packages, the teachers aided in setting up the documents to be keyed.

Statistical Analysis of the Data

The problem of this study was to determine if a significant difference exists in the number and types of errors located when proofreading hardcopy versus softcopy business documents. It was addressed through three research questions. The data analyses procedures used for each question follow:

1. Does a difference exist in the number of errors subjects locate when proofreading from hardcopy versus softcopy media for different types of business documents?

This question was analyzed through a two within-subjects analysis of variance design and through examination of the means and standard deviations. This approach can be conceptualized in two different ways--as a repeated-measures design in which all variables are within-subjects variables or as a factorial design in which `Subjects' is a variable. For this study, the latter design was used with significance set at the .05 level; it can be conceptualized as being factorial because every subject is paired with every combination of every variable; that is, S X A X B--with one score per cell, where S = subjects, A = type of copy, and B = type of document (Howell, 1987, pp. 452-453). Every subject proofread each of the three documents on both hardcopy and softcopy media. The media on which the subjects were to proofread documents were assigned on a randomized basis; therefore, the design also included a test for sequence effect. The order in which the documents were proofread was not randomized. The following design, which has been extrapolated from <u>Statistical Methods for Psychology</u> (Howell, p. 455), illustrates the model used for analyzing the data:

Design with Repeated Measures on all Variables

Source	df	SS	MS	F	S
S					
A					
A X S					
B					
B X S					
AB					
AB X S					
Total					

Duncan's Multiple Range test was completed to determine means that were significantly different from one another.

2. Does a difference exist in the number of errors subjects locate according to type of error when proofreading from hardcopy versus softcopy media for different types of business documents?

This question was answered through an analysis of the percentage and number of subjects finding each type of error on each document.

3. Do personal characteristics of the subjects relate to the ability to locate errors when proofreading from hardcopy versus softcopy media for different types of business documents?

For the personal characteristic of number of times a subject proofread a document, a four-way analysis of variance was used. The four independent variables were: (a) type of copy, (b) type of document, (c) sequence, and (d) number of times proofread. For the personal characteristic, glare on the computer screen while

proofreading, a two-way analysis of variance was used. The two independent variables were: (a) type of document, and (b) glare on computer. For all other characteristics, a three-way analysis of variance was used. The first two independent variables for these analyses were: (a) type of copy, and (b) type of document. The third independent variable for each was, in order: (a) years of computer experience, (b) instruction in proofreading techniques, and (c) lenses worn while proofreading. Means and standard deviations for all personal characteristics were also computed. Duncan's Multiple Range Test was used to determine means that were significantly different from one another.

CHAPTER 4

FINDINGS

The problem of this study was to determine if a
difference exists in the number and types of errors
subjects find when proofreading hardcopy versus softcopy
business documents. The following findings will be
discussed: (a) pilot test subject characteristics,
(b) subject characteristics, (c) subject background
information, (d) means and standard deviations, and
(e) research questions and hypotheses.

Pilot Test Subject Characteristics

The pilot test subject characteristics are shown in
in Table 2. Fifteen students in a Secretarial
Administration I class participated in the pilot test.
However, scores of only 14 were analyzed. One softcopy
proofreader's set of scores was not evaluated as the
computer the student was using malfunctioned. The pilot
group consisted of 57% juniors and 43% seniors; 93% of the
group were females.

Subject Characteristics

Table 3 contains the characteristics of the subjects
who participated in the actual study. Of the 69 subjects
participating in the study, scores of only 61 were
analyzed. The reasons for not analyzing the scores of 8
subjects include: (a) 1 student's computer malfunctioned,

Table 2

Pilot Test Subject Characteristics

Characteristic	Frequency
Class	
Junior	8
Senior	6
Sex	
Male	1
Female	13
Business education course	
Richlands H.S.	
Secretarial Administration I	14

Note. $\underline{n}$ = 14.

Table 3

Subject Characteristics

Characteristic	Frequency
Class	
Junior	13
Senior	48
Sex	
Male	1
Female	60
Business education course	
Richlands H.S.	
Secretarial Administration I	19
Secretarial Administration II	19
Office Specialist II	12
Tazewell H.S.	
Office Specialist II	11

Note. n = 61.

and (b) 7 students were absent for one of the testing days. Students in three types of business education classes participated in the study. The three classes were Secretarial Administration I & II and Office Specialist II. As in the pilot group, 93% were females. Seventy-nine percent of the 61 subjects were seniors; 21% were juniors.

Subject Background Information

The subjects' background information is summarized in Table 4. The first variable, years of computer experience, showed that subjects' responses were closely distributed in three answer categories, with 30% of the subjects having 0 to 1 year of computer experience; 38% having 1 to 2 years of computer experience; and 33% having 2 or more years of computer experience. In further analysis of the data, the previous three categories were used instead of the originial seven response categories. Only three subjects responded to having 3 or more years of computer experience, not a large enough number to use as a separate category on statistical analyses. Three fourths of the subjects indicated that they had previous proofreading instruction. Twenty-five percent of the subjects wore glasses or contact lenses, either some or all of the time that they proofread. Approximately 98% of the subjects indicated that they enjoyed working with the computer and that they were physically comfortable when working at the computer.

Table 4

Subject Background Information Summary

Background information	Frequency
Years of computer experience	
0-1	18
1-2	23
2-3	17
3-4	2
4-5	0
5-6	1
6 or more	0
Formal proofreading instruction	
Yes	46
No	15
Corrective lenses worn while proofreading	
Yes	12
No	46
Sometimes	3
Enjoy working with the computer	
Yes	56
No	1
Sometimes	4
Physically comfortable at computer	
Yes	53
No	2
Sometimes	6
Glare on computer	
Yes	1
No	36
Sometimes	24
Colors on screen bother eyes	
Yes	1
No	43
Sometimes	17

Note. n = 61.

Since at least a 25% response rate in each of the answer categories was found for the following variables, they were analyzed: (a) years of computer experience, (b) formal proofreading instruction, (c) corrective lenses worn while proofreading, and (d) glare on the computer screen when proofreading. Even though the variable colors on the screen being bothersome to the subjects' eyes had a 30% response in the "Yes" or "Sometimes" categories, it was not analyzed since only 2% of the responses were in the "Yes" category. Due to high response rates to the answer category "Yes", the following variables were not analyzed: (a) enjoy working with the computer, and (b) physically comfortable while at the computer.

Means and Standard Deviations

Table 5 contains the means and standard deviations for the following variables: (a) type of copy, (b) type of document, (c) sequence, (d) number of times document was proofread, (e) years of computer experience, (f) formal proofreading instruction, (g) corrective lenses worn while proofreading, and (h) glare on computer screen while proofreading. For all of the variables, the subjects found an average of 11.1 to 13.1 errors per document; standard deviations ranged from 1.38 to 2.26.

Table 5

Means and Standard Deviations for Errors Located by Type
of Copy, Type of Document, Sequence, and Personal
Characteristics

Variable	n	Mean	Standard deviation
Type of copy[a]			
Hard	183	11.8	2.05
Soft	183	11.7	2.10
Type of document[a]			
Letter	122	11.8	2.18
Memo	122	11.1	2.14
Report	122	12.3	1.70
Sequence[a]			
Hardcopy first	183	11.6	2.12
Softcopy first	183	11.9	2.00
Proofread[b]			
1 time	15	11.2	1.52
2 times	162	11.6	2.16
3 times	128	11.8	2.13
4 times	46	11.7	1.74
5 times	12	13.1	1.38
Computer Experience[c]			
0-1 year	18	11.7	1.91
1-2 years	23	12.2	1.94
2 or more years	20	11.3	2.26
Proofreading instruction[c]			
Yes	46	11.7	2.19
No	15	12.0	1.65
Corrective lenses[c]			
Yes/sometimes	15	11.4	2.19
No	46	11.8	2.02
Glare[c]			
Yes/sometimes	25	11.7	2.01
No	36	11.7	2.16

[a]Each subject was counted six times for the statistical
analyses related to this variable.

[b]The total number for documents proofread one to five times
is 363; two subjects proofread a document six times, and
one subject proofread a document seven times. These
subjects were excluded from the statistical analyses for
this variable.

[c]Each subject was counted one time for the statistical
analyses related to this variable.

Research Questions and Hypotheses

Research Question 1 and Hypotheses

The first research question is: Does a difference exist in the number of errors subjects locate when proofreading from hardcopy versus softcopy media fordifferent types of business documents? For this research question, four hypotheses were tested. Outcomes of the tests for the hypotheses can be found in Table 6.

Hypothesis 1: No significant difference exists at the .05 level in the number of errors located when subjects proofread from hardcopy versus softcopy media. As reported in Table 6, a significant F ratio was not obtained for the type of copy; therefore, the hypothesis was not rejected.

Hypothesis 2: No significant difference exists at the .05 level in the number of errors located when subjects proofread from letters, memos, or reports. The F ratio is .0001 and, therefore, it is significant at the .05 level. A Duncan's Multiple Range test was completed to determine means that are significantly different from one another. The results indicated that all the means were significantly different from each other. Thus, the null hypothesis was rejected. Even though the means are different statistically, the numerical values of the means indicate that they are not practically different from each other;

Table 6

Analysis of Variance for Errors Located by Copy, Document, and
Sequence

Source	Degrees of freedom	F value	F probability	Mean
Type of copy	1	1.60	.2065	
Hard				11.8
Soft				11.7
Type of document	2	21.13	.0001	
Letter				11.8
Memo				11.1
Report				12.3
Sequence	1	5.74	.0172	
Hardcopy first				11.6
Softcopy first				11.9
Interactions				
Copy by document	2	3.54	.0302	
Subjects	60			
Error	299			
Total	365			

the values were less than 1/2 a standard deviation different among the means.

Hypothesis 3: No significant difference exists at the .05 level in the number of errors located when subjects proofread hardcopy versus softcopy documents first. A significant F ratio exists for this hypothesis; therefore, the null hypothesis was rejected. An analysis of the means indicated that they are different from each other and that the sequence, softcopy first, resulted in subjects finding more errors. Even though the means are different statistically, the numerical values of the means indicate that they are not practically different from each other. When adding the standard deviations to each, the results are: softcopy = 13.90 and hardcopy = 13.72; these both round to 14 errors.

Hypothesis 4: No interaction exists at the .05 level for errors located on hardcopy versus softcopy media due to subjects proofreading from letters, memos, or reports. A significant F ratio exists for this hypothesis; therefore, the null hypothesis was rejected. In order to determine where the difference lies, the means were plotted on a graph; the results are reported in Figure 1. Examination of Figure 1 indicates that the means for all types of documents are clustered together for the softcopy, whereas the means for the hardcopy are spread apart.
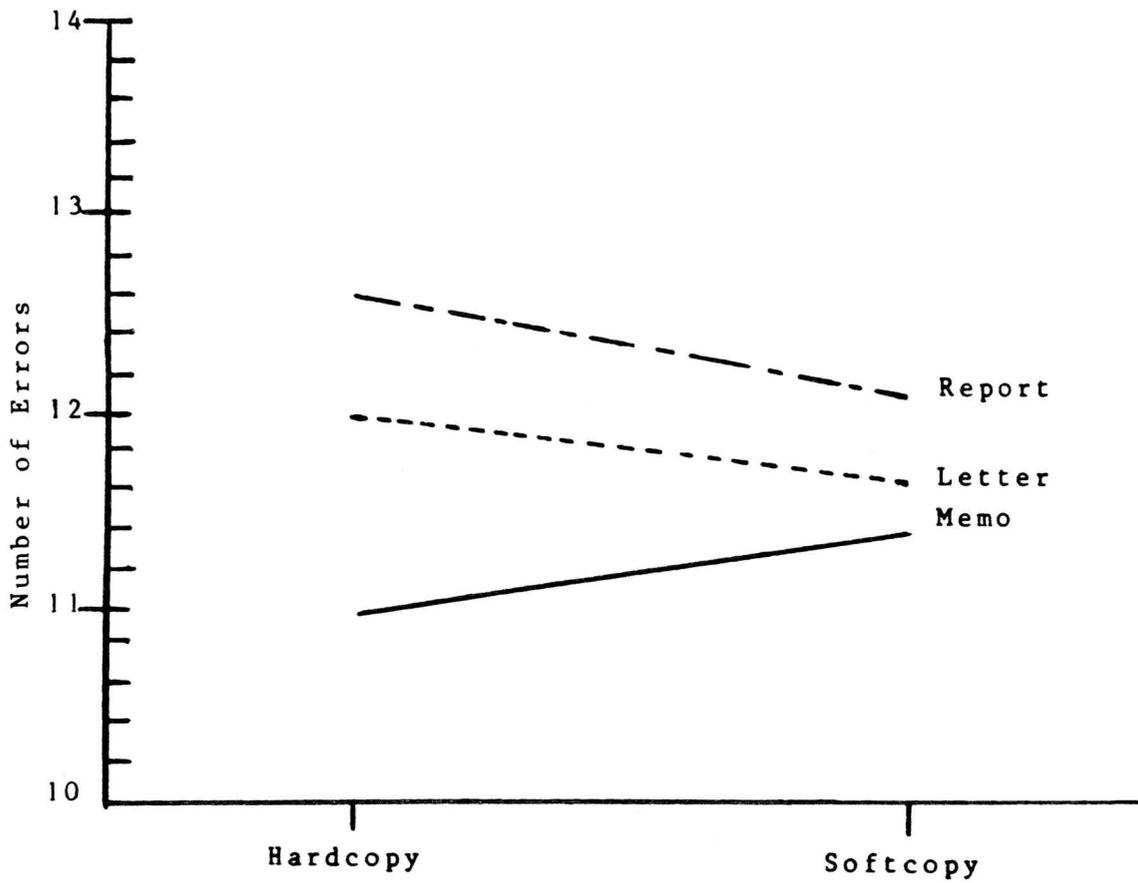
Figure 1. Number of errors located for documents read from hardcopy and from softcopy media

Research Question 2

The second research question is: Does a difference exist in the number of errors subjects locate according to type of error when proofreading from hardcopy versus softcopy media for different types of business documents? As shown in Table 7, results indicate that the subjects either had the same ease, or the same difficulty, finding the same types of errors, whether they proofread from hardcopy or softcopy media. For example, more than 80% of the students found the following errors on both hardcopy and softcopy media: (a) omission of a space after a word, (b) addition of a letter, (c) addition of a space in a word, (d) addition of a stray letter, (e) addition of an important letter, (f) transposition of words, and (g) substitutions. On the other hand, only 79% or less of the students found the following errors on both hardcopy and softcopy media: (a) misstrokes, (b) omission of a letter, (c) omission of an important letter, (d) addition of a word, (e) transposition of letters, (f) omission of a character, (g) omission of a space after a comma, and (h) addition of a space before a comma.

In analyzing the number of errors found by type of error when proofreading different documents, no pattern emerged. The percentage of subjects finding certain errors varies within each document. The results do support earlier findings that the subjects find the most errors

Number and Percentage of Subjects Locating Different Types of Errors

Types of errors		Report		Memo		Letter		Total	
		No.	%	No.	%	No.	%	No.	%
Omissions									
Letter	HC[a]	56	91.8	56	91.8	32	52.4	144	78.6
	SC[a]	56	91.8	52	85.2	31	50.8	139	75.9
Important letter	HC	41	67.2	39	· 63.9	51	83.6	131	71.5
	SC	34	55.7	35	57.3	44	72.1	113	61.7
Character	HC	45	73.7	12	19.6	33	54.0	90	49.1
	SC	47	77.0	35	57.3	35	57.3	117	63.9
Space after word	HC	61	100.0	58	95.0	60	98.3	179	97.8
	SC	60	98.3	59	96.7	61	100.0	180	98.3
Space after comma	HC	33	54.0	35	57.3	43	70.4	111	60.6
	SC	43	70.4	44	72.1	38	62.2	125	68.3
Additions									
Letter	HC	60	98.3	47	77.0	59	96.7	166	90.7
	SC	60	98.3	46	75.4	58	95.0	164	89.6
Important letter	HC	51	83.6	58	95.0	46	75.4	155	84.6
	SC	50	81.9	54	88.5	47	77.0	151	82.5
Word	HC	57	93.4	30	49.1	47	77.0	134	73.2
	SC	52	85.2	32	52.4	46	75.4	130	71.0
Space in word	HC	60	98.3	59	96.7	61	100.0	180	98.3
	SC	61	100.0	61	100.0	60	98.3	182	99.4
Space before comma	HC	23	37.7	33	54.0	40	65.5	96	52.4
	SC	26	42.6	44	72.0	49	80.0	119	65.0
Stray letter	HC	61	100.0	61	100.0	61	100.0	183	100.0
	SC	61	100.0	60	98.3	58	95.0	179	97.8
Transpositions									
Letters	HC	49	80.3	43	70.4	43	70.4	135	73.7
	SC	38	62.2	40	65.5	33	54.0	111	60.6
Words	HC	49	80.3	57	93.4	52	85.2	158	86.3
	SC	41	67.2	49	80.3	55	90.1	145	79.2
Other									
Misstroke	HC	59	96.7	40	65.5	48	78.6	147	80.3
	SC	57	93.4	43	70.4	43	70.4	143	78.1
Substitution	HC	61	100.0	41	67.2	53	86.8	155	84.6
	SC	61	100.0	41	67.2	49	80.3	151	82.5

[a]HC refers to hardcopy, which is a document typed or printed on paper; SC refers to softcopy, which is document displayed on a computer screen.

when proofreading, in order, the report, the letter, and the memo. Seventy percent or more of the subjects found 12 of the 15 errors on the report; 70% or more of the subjects found 11 of the 15 errors on the letter; and 70% or more of the subjects found 7 of the 15 errors on the memo.

Research Question 3

The third research question is: Do personal characteristics of the subjects relate to the ability to locate errors when proofreading from hardcopy versus softcopy media for different types of business documents? Five variables were analyzed; each of the variables has corresponding hypotheses. Each variable and its corresponding hypotheses will be discussed separately.

Variable One. The first variable to be analyzed was how many times the subjects proofread the documents. Table 8 depicts the results; four hypotheses were tested. Since the outcomes for the first two hypotheses are essentially the same as those discussed for Research Question 1, even with the added variable of number of times proofread, only the third hypothesis and the one related to this variable are discussed.

The hypothesis tested for sequence is: No significant difference exists at the .05 level in the number of errors located when subjects proofread from hardcopy versus softcopy media first. A significant F ratio was not found, therefore, the null hypothesis was not rejected.

Table 8

Analysis of Variance for Errors Located by Copy, Document, Sequence, and Number of Times Proofread

Source	Degrees of freedom	F value	F probability	Mean
Type of copy	1	0.69	.4054	
Hard				11.8
Soft				11.7
Type of document	2	10.00	.0001	
Letter				11.8
Memo				11.1
Report				12.3
Sequence	1	1.55	.2141	
Hardcopy first				11.6
Softcopy first				11.9
Proofread[a]	4	1.73	.1120	
1 time				11.2
2 times				11.6
3 times				11.8
4 times				11.7
5 times				13.1
Interactions				
Copy by document	2	3.72	.0253	
Error	353			
Total	363			

[a]Confidence interval data for number of times documents were proofread appears in Table 9.

The hypothesis for number of times a document was proofread is: No significant difference exists at the .05 level in the number of errors located when subjects proofread a different number of times. A significant F ratio was not found; therefore, the null hypothesis was not rejected. Even though there is not a significant F ratio, a pattern in the mean number of errors students found when proofreading documents varying number of times emerged. Students who proofread a document one, two, three, or four times found an average of 11.5 errors, or 77% of the total number of errors; while students who proofread a document five times found an average of 13.1 errors, or 87% of the total number of errors. Confidence interval data for the number of times documents were proofread were computed. They are reported in Table 9 and support the finding that proofreading one through four times resulted in subjects locating the same number of errors, while proofreading five times leads to a higher number of errors being found.

Variable Two. The second variable to be discussed is how many years of computer experience a subject had. The results of the analysis of variance for this variable are shown in Table 10. Four hypotheses were analyzed. Outcomes for two of them are similar to findings discussed for Research Question 1. For the interaction hypothesis

Table 9

Confidence Intervals for Number of Times Proofread

Proof comparison	Lower confidence limit	Difference between means	Upper confidence limit
5-4	.0698	1.3442	2.6186[a]
5-3	.1464	1.3333	2.5203[a]
5-2	.2713	1.4475	2.6238[a]
5-1	.3606	1.8833	3.4060[a]

[a]Comparisons are significant at the .05 level.

Table 10

Analysis of Variance for Errors Located by Copy, Document, and Years of Computer Experience

Source	Degrees of freedom	F value	F probability	Mean
Type of copy	1	.52	.4719	
Hard				11.8
Soft				11.7
Type of document	2	10.70	.0001	
Letter				11.8
Memo				11.1
Report				12.3
Computer experience	2	6.30	.0021	
0-1 year				11.7
1-2 years				12.2
2 or more years				11.3
Interactions				
Copy by document	2	1.78	.1694	
Experience by copy	2	1.36	.2581	
Experience by document	4	.97	.4248	
Error	352			
Total	365			

related to copy by document, no significant interaction was
found.

For the other hypothesis, no significant difference
exists at the .05 level in the number of errors located by
subjects having different years of computer experience, the
F ratio is .0021. It is, therefore, significant at the
.05 level. A Duncan's Multiple Range test was completed to
determine means that are significantly different from one
another. The results indicated that mean 2 (1 to 2 years
computer experience) was significantly different from mean
3 (2 or more years computer experience). Thus, the null
hypothesis was rejected. Even though the means are
statistically significant, they are not practically
different. When adding the standard deviations to each
mean, the results are, respectively, 13.61, 14.14, and
13.56. When these numbers are rounded to determine the
number of errors found, they all round to 14 errors.

Variable Three. The third variable analyzed was
whether a subject had previous instruction in proofreading
techniques, either in school or on the job. Table 11
depicts the results of the analysis of variance computed
for this variable. Four hypotheses were tested, two of
them are similar to the those discussed for Research
Question 1 with similar outcomes. For the interaction
hypothesis related to copy by document, no significant
interaction was found.

Table 11

Analysis of Variance for Errors Located by Copy, Document, and Formal Proofreading Instruction

Source	Degrees of freedom	F value	F probability	Mean
Type of copy	1	.16	.6910	
Hard				11.8
Soft				11.7
Type of document	2	5.49	.0045	
Letter				11.8
Memo				11.1
Report				12.3
Proofreading instruction	1	1.98	.1603	
Yes				11.7
No				12.0
Interactions				
Copy by document	2	1.73	.1784	
Instruction by copy	1	.34	.5626	
Instruction by document	2	.99	.3708	
Error	356			
Total	365			

For the hypothesis tested for subjects having or not having formal proofreading instruction, no significant difference exists at the .05 level. Therefore, the null hypothesis was not rejected.

Variable Four. The fourth variable analyzed was whether the subjects wore glasses or contact lenses while they proofread. Table 12 depicts the analysis of variance results. For the four hypotheses tested, again two are similar to the hypotheses discussed for Research Question 1, with similar outcomes. For the interaction hypothesis related to copy by document, no significant interaction was found.

The additional hypothesis is: No significant difference exists at the .05 level in the number of errors located when subjects proofread with or without corrective lenses. A significant F ratio was not found, therefore, the null hypothesis was not rejected.

Variable Five. The last variable analyzed was whether a glare on the computer screen while the subjects proofread the documents was related to proofreading outcomes. The results of the analysis of variance are reported in Table 13. Three hypotheses were analyzed, two with outcomes similar to those discussed in Research Question 1.

The additional hypothesis is: No significant exists at the .05 level in the number of errors located when subjects proofread with or without glare on computers. The

Table 12

Analysis of Variance for Errors Located by Copy, Document, and Corrective Lenses Worn While Proofreading

Source	Degrees of freedom	F value	F probability	Mean
Type of copy	1	.34	.5614	
Hard				11.8
Soft				11.7
Type of document	2	9.92	.0001	
Letter				11.8
Memo				11.1
Report				12.3
Corrective lenses	1	2.57	.1097	
Yes/sometimes				11.4
No				11.8
Interactions				
Copy by document	2	1.73	.1787	
Lenses by copy	1	.05	.8275	
Lenses by document	3	.71	.4945	
Error	356			
Total	365			

Table 13

Analysis of Variance for Errors Located by Copy, Document, and Glare on Computer Screen While Proofreading

Source	Degrees of freedom	F value	F probability	Mean
Type of document	2	1.76	.1755	
Letter				11.8
Memo				11.1
Report				12.3
Glare	1	0.00	.9897	
Yes/sometimes				11.7
No				11.7
Interactions				
Glare by document	2	.17	.8413	
Error	177			
Total	182			

F ratio was not significant, therefore, the null hypothesis was not rejected.

Summary

For the first research question, there was a significant F ratio for the interaction of copy by document. When analyzing the variables to see where the significance lies, there is a significant F ratio for the variable, document; there is not a significant F ratio for the variable, copy. Even though there was a statistically significant F ratio, the results are not practically significant because the values were less than 1/2 standard deviation different among the means.

For the second research question, the medium was not related to the specific types of errors located. More than 80% of the subjects found the following errors on both hardcopy and softcopy media:

* omission of a space after a word
* addition of a letter
* addition of a space in a word
* addition of a stray letter
* addition of an important letter
* transposition of words
* substitutions

However, only 40-79% of the subjects found the following types of errors on both hardcopy and softcopy media:

* misstrokes
* omission of a letter
* omission of an important letter
* addition of a word
* transposition of letters

* omission of a character
* omission of a space after a comma
* addition of a space before a comma

For the third research question, a significant difference did not exist for subjects: (a) proofreading from hardcopy versus softcopy media first, (b) having previous formal proofreading instruction, (c) wearing glasses or contact lenses while proofreading, and (d) having a glare on the computer screen while proofreading. A significant difference did not exist, but a pattern in the mean number of errors found emerged for the number of times a document was proofread. Confidence interval data for the number of times documents were proofread were computed that supported the finding that proofreading one through four times resulted in subjects locating the same number of errors, while proofreading five times lead to a higher number of errors being found.

A significant difference did exist for subjects having different years of computer experience; however, the numerical values were not practically different from each other.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem of this study was to determine if a difference exists in the number and types of errors located when proofreading hardcopy versus softcopy business documents. Hardcopy refers to a business document typed or printed on paper; softcopy refers to a business document displayed on a computer screen. The problem was addressed through the following questions:

1. Does a difference exist in the number of errors subjects locate when proofreading from hardcopy versus softcopy media for different types of business documents?

2. Does a difference exist in the number of errors subjects locate according to type of error when proofreading from hardcopy versus softcopy media for different types of business documents?

3. Do personal characteristics of the subjects relate to the ability to locate errors when proofreading from hardcopy versus softcopy media for different types of business documents?

Summary

To obtain data, 61 high school students who were enrolled in Secretarial Administration I, Secretarial Administration II, or Office Specialist II classes participated in the study. Each subject proofread the same

three documents--a letter, a report, and a memo--on both hardcopy and softcopy media, for a total of six documents. For each media, the subjects proofread each document for 15 to 20 minutes over a period of 1 hour. Data collected from proofreading the hardcopy and softcopy documents were used to answer the first two, and part of the third, research questions. Each subject also completed a background information sheet that was used to collect personal information needed to answer the third research question.

For Research Question 1, a significant difference did not exist in the number of errors located by subjects who proofread on hardcopy versus softcopy media. A significant difference did exist for: (a) subjects who proofread different types of documents, (b) subjects who proofread on hardcopy versus softcopy media first, and (c) the interaction of copy by document. Even though the means were statistically different, the numerical values of the means indicate that they are not practically different from each other.

For Research Question 2, results indicate that the medium was not related to the specific types of errors found.

Eighty percent or more of the subjects found the following errors, both on hardcopy and softcopy media: (a) omission of a space after a word, (b) addition of a

letter, (c) addition of a space in a word, (d) addition of a stray letter, (e) addition of an important letter, (f) transposition of words, and (g) substitutions. Forty to 79 percent of the subjects found the following errors, both on hardcopy and softcopy media: (a) misstrokes, (b) omission of a letter, (c) omission of an important letter, (d) addition of a word, (e) transposition of letters, (f) omission of a character, (g) omission of a space after a comma, and (h) addition of a space before a comma.

For Research Question 3, five variables were analyzed: (a) how many times the subjects proofread the documents, (b) how many years of computer experience a subject had, (c) whether a subject had previous instruction in proofreading, (d) whether the subjects wore glasses or contact lenses while they proofread, and (e) whether there was a glare on the computer screen while the subjects proofread. For all variables, the outcomes for several of the hypotheses are essentially the same as those for Research Question 1 even with the added personal characteristics variables. A signficant difference did not exist in the number of errors located by: (a) subjects proofreading from hardcopy versus softcopy media first, (b) subjects having previous proofreading instruction, (c) subjects wearing glasses or contact lenses while proofreading, and (d) subjects having a glare on the

computer screen while proofreading. Even though a significant F ratio was not found for the number of times a document was proofread, a pattern in the mean number of errors found emerged--proofreading one through four times resulted in subjects locating the same number of errors; while proofreading five times lead to higher number of errors being found. A significant difference did exist in the number of errors located by students having different years of computer experience. Again, even though the means are statistically different, the numerical values of the means indicate that they are not practically different from each other.

Conclusions

The following conclusions are based upon the findings of this study.

1. Students need not print hardcopy documents in an attempt to locate additional errors. In this study, the medium was not related to the number of errors found.

2. The errors in the memo proved more difficult to locate, feasibly due to their location within it. Subjects in this study located one more error in the reports and letters than in the memos.

3. Business educators need to be less concerned about the type of copy and document students are proofreading and more concerned about the types of errors students are trying to locate. The subjects in this study were more

likely to locate some types of errors on both hardcopy and softcopy media than other types of errors.

4. Past instructional procedures used with the students did not help them locate more errors than students who indicated they had not had proofreading instruction. This supports research findings by West (1983) that training in proofreading techniques has no apparent effect on proofreading proficiency.

5. Teachers need not be greatly concerned about the following factors affecting a student's ability to locate errors in hardcopy versus softcopy documents: (a) wearing, or not wearing, corrective lenses while proofreading; and (b) having, or not having, a glare on the computer screen while proofreading.

6. Proofreading one time for keyboarding errors appears adequate over a short period of time (15 to 20 minutes), as subjects in this study found 75% of the errors in one reading; increased number of readings, two through four times, resulted in students locating only 3% more errors, or 78% of the total number of errors. Students who proofread five times located 87% of the errors. Thus, advising a student to read copy once for typographical errors seems logical based on findings of this study.

7. Having more than 2 years computer experience does not aid a student in locating errors. In this study, students who had 0 to 2 years of computer experience

located, on the average, one more error per document than those with more years of computer experience.

Recommendations for Instruction

The following recommendations for instruction are based upon the findings of this study:

1. Individuals working with a computer should proofread from the computer screen, not from the printout when the proofreading is completed as in this study, for periods of 15 to 20 minutes over an hour's time.

2. Teachers should be aware of the following factors, which contribute to the likelihood of students locating errors when proofreading, when teaching proofreading skills: (a) placement of errors in the text, (b) types of errors, and (c) types of documents.

3. Personal characteristics including proofreading instruction; wearing, or not wearing, corrective lenses while proofreading; and having, or not having, a glare on the computer screen while proofreading, do not relate significantly to students' ability to locate errors. However, researchers (Chol, 1985; Dolecheck, 1984; Fredrickson, 1982; Galitz, 1984; O'Connor & Regan, 1986; Swanson, 1986) have found that there are potential health hazards of computer use to students. Therefore, teachers should be aware of these hazards and avoid having students work under proofreading conditions that may negatively affect their health.

4. Teachers should continue advising students to proofread one time when locating keyboarding errors such as the subjects in this study located, as noted by Camp (1979), Dewar and Daniels (1987), Seitz (1986), Sobolik (1975), and West (1983). For practical purposes, the same number of errors were located in one reading as in five readings.

Recommendations for Further Research

The following recommendations for further research are based upon the conclusions of this study:

1. A similar study should be completed with subjects proofreading for longer periods time.

2. A similar study should be completed with subjects proofreading longer business documents.

3. A study should be completed in which subjects are specifically trained to locate the types of keyboarding errors included in the documents of this study.

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APPENDIX A

DEFINITIONS AND EXAMPLES OF
EACH TYPE OF ERROR

Omission of a letter--a type of keyboarding error occurring when an operator leaves out a letter in a word. The resulting word is not an English word. For example, "confused" is incorrectly keyed as "confusd."

Omission of an important letter--a type of keyboarding error occurring when an operator leaves out a letter in a word, the result being that the word looks like a correct word. For example, "bridge" is incorrectly keyed as "bride."

Omission of a character--a type of keyboarding error occurring when an operator leaves out a character in a word, group of words, or a line of keyed copy. For example, "(19)" is incorrectly keyed as "(19".

Omission of a space after a word--a type of keyboarding error occurring when an operator leaves out a space between two words. For example, "the meeting" is incorrectly keyed as "themeeting."

Omission of a space after a comma--a type of keyboarding error occurring when an operator leaves out a space between a comma and the following word. For example, "and, I" is incorrectly keyed as "and,I."

Addition of a letter--a type of keyboarding error occurring when an operator adds a letter to a word. The resulting word is not an English word. For example, "debited" is incorrectly keyed as "debitted."

<u>Addition of an important letter</u>--a type of keyboarding error occurring when an operator adds a letter to a word, the result being that the word looks like a correct word. For example, "exit" is incorrectly keyed as "exist."

<u>Addition of a word</u>--a type of keyboarding error occurring when an operator keys the same word twice consecutively. For example, "the car" is incorrectly keyed as "the the car."

<u>Addition of a space in a word</u>--a type of keyboarding error occurring when an operator adds a space in a word. For example, "professional" is incorrectly keyed as "pro fessional."

<u>Addition of a space before a comma</u>--a type of keyboarding error occurring when an operator adds a space between a word and the following comma. For example, "and, the" is incorrectly keyed as "and , the."

<u>Addition of a stray letter</u>--a type of keyboarding error occurring when an operator adds an extra letter to a word due to the sensitivity of an electronic typewriter or keyboard to the operator's touch. The resulting word is not an English word. For example, "couch" is incorrectly keyed as "coujch."

<u>Misstroke</u>--a type of keyboarding error occurring when an operator keys a word incorrectly. The resulting word has the same number of letters as the original word and

looks like a correct word. For example, "than" is incorrectly keyed as "that."

Transposition of letters or words--a type of keyboarding error occurring when an operator keys letters or words in the reverse order. The resulting transposition can look like a correct word or set of words, but it doesn't make sense when used in place of the original word or words. For example, "angel" is incorrectly keyed as "angle."

Substitution--a type of keyboarding error occurring when an operator substitutes one letter for another. The original and incorrectly keyed letters are usually adjacent keys on the keyboard. The resulting word is not an English word. For example, "defined" is incorrectly keyed as "definrd."

APPENDIX B

PERMISSION FROM SOUTH-WESTERN
PUBLISHING COMPANY

Ms. Janice Heashe
South-Western Publishing Co.
5101 Madison Road
Cincinnati, OH 45227

Dear Ms. Heashe:

Thank you for talking with me over the phone regarding the
research which I am am doing for my master's thesis. I
appreciate the verbal agreement you gave me to duplicate two
pages from Programmed Proofreading, which Southwestern
publishes. These pages will be used to collect data on the
proofreading skills of high school students.

Here is the request in written form for your records.
Specifically, the two pages which can be found in Programmed
Proofreading, 2nd edition, written by T.J. Dewar and H.F.
Daniels are:

1. page 115--memorandum.
2. page 132--letter of recommendation.

Thank you very much for your assistance in this matter. If
you have any questions, feel free to write me at the above
address.

Sincerely,

Karen K. Seibel

May 26, 1988

Thank you very much for sending a written request for the permission to use material from
PROGRAMMED PROOFREADING, Second Edition, in your master's thesis. This permission is
granted by this note. We are pleased to have this opportunity to be of help to you.

Mrs. Janice Heashe
Permissions Coordinator

APPENDIX C

PERMISSION FROM GREGG DIVISION OF
MCGRAW-HILL PUBLISHING COMPANY

Verbal approval for thesis use only for the report on
p. 91 in <u>Gregg Typing I: Keyboarding and Processing</u>
<u>Documents</u> (Lloyd, Winger, Johnson, Morrison, & Hall; 1987)
was secured from Ms. Camille Truchell on April 23, 1988.

APPENDIX D

SPECIFIC ERRORS INCORPORATED
INTO THE REPORT

REPORT

Omissions

1. letter--"diference" for "difference"

2. important letter--"on" for "own"

3. character--"`user-friendly" for "`user-friendly'"

4. space after a word--"computersare" for
    "computers are"

5. space after a comma--"Layman,Dean" for "Layman, Dean"

Additions

6. letter--"playyer" for "player"

7. important letter--"two" for "to"

8. word--"it it is" for "it is"

9. space in a word--"pro grams" for "programs"

10. space before a comma--"Pascal ," for "Pascal,"

11. stray letter--"simpkle" for "simple"

Misstrokes

12. "in" for "is"

Transpositions

13. letters--"dirve" for "drive"

14. words--"do you" for "you do"

Substitutions

15. "charactee" for "character"

APPENDIX E

SPECIFIC ERRORS INCORPORATED
INTO THE MEMO

MEMO

Omissions

1. letter--"sugestion" for "suggestion"

2. important letter--"through" for "thorough"

3. character--"(4" for "(4)"

4. space after a word--"tothe" for "to the"

5. space after a comma--"Layman,Dean" for "Layman, Dean"

Additions

6. letter--"useage" for "usage"

7. important letter--"then" for "the"

8. word--"the the staff" for "the staff"

9. space in a word--"re searching" for "researching"

10. space before a comma--"findings ," for "findings,"

11. stray letter--"responsibilkities" for
    "responsibilities"

Misstrokes

12. "if" for "of"

Transpositions

13. letters--"thier" for "their"

14. words--"who know" for "know who"

Substitutions

15. "interestad" for "interested"

APPENDIX F

SPECIFIC ERRORS INCORPORATED
INTO THE LETTER

LETTER

Omissions

1. letter--"Personel" for "Personnel"

2. important letter--"he" for "her"

3. character--"work" for "work."

4. space after a word--"andthen" for "and then"

5. space after a comma--"reference,I" for "reference, I"

Additions

6. letter--"refference" for "reference"

7. important letter--"now" for "no"

8. word--"to to the" for "to the"

9. space in a word--"em ployee" for "employee"

10. space before a comma--"appearance ," for "appearance,"

11. stray letter--"severajl" for "several"

Misstrokes

12. "than" for "that"

Transpositions

13. letters--"freqeuntly" for "frequently"

14. words--"time that" for "that time"

Substitutions

15. "umsatisfactory" for "unsatisfactory"

APPENDIX G

SOFTCOPY INSTRUCTION SHEET

Instructions--Softcopy

You are participating in a study to help determine proofreading skills of high school students. In order to make the study valid and reliable, please do the best you can. Your identity will remain anonymous. (<u>Note</u>: Please do not write on this sheet. It will be turned in upon completion of all the exercises.)

Steps in proofreading on the softcopy:

1. Call up the document. The researcher will give you the name of the document.

2. Key in your i.d. number in the top right-hand corner of the document in the space provided. You will find your i.d. number located on the top right-hand corner of your background information sheet.

3. Proofread the document <u>without</u> the help of others. Assume that all dates, numbers, and names are correct. You may use a dictionary.

4. Correct any errors in the document.

5. When you have finished making any changes, key in how many times you read through the document in the space provided at the bottom of the document.

6. If time has not been called, print out the document.

7. Do not turn the document in until time is called; do not attempt to start on another document. Sit quietly until the researcher calls time.

You will have 20 minutes to complete this exercise. You may use some or all of the time to proofread the document. There is to be no talking during this exercise.

Ready. Begin.

APPENDIX H

HARDCOPY INSTRUCTION SHEET

Instructions--Hardcopy

You are participating in a study to help determine
proofreading skills of high school students. In order to
make the study valid and reliable, please do the best you
can. Your identity will remain anonymous. (<u>Note</u>: Please
do not write on this sheet. It will be turned in upon
completion of all the exercises.)

Steps in proofreading on the softcopy:

1. Write your i.d. number in the top right-hand corner of
    the answer sheet in the space provided. You will find
    your i.d. number located on the top right-hand corner
    of your background information sheet.

2. Write your i.d. number in the top right-hand corner of
    the document in the space provided.

3. Proofread the document <u>without</u> the help of others.
    Assume that all dates, numbers, and names are correct.
    You may use a dictionary.

4. Circle any errors, and place the corrections on the
    answer sheet provided. Put only one correction per
    line. You may not need to use all of the lines that
    are provided. Please write neatly.

5. When you have finished making any changes, write in how
    many times you read through the document in the space
    provided at the bottom of the document.

6. Do not turn the document in until time is called. Sit
    quietly until the researcher calls time.

You will have 15 minutes to complete this exercise. You
may use some or all of the time to proofread the document.
There is to be no talking during this exercise.

Ready. Begin.

APPENDIX I

BACKGROUND INFORMATION SHEET

i.d. number _____

Background Information

Directions: Circle the correct response. Keep this sheet until the researcher calls for you to turn it in.

1. How many years have you had of computer experience? (Circle only the highest level.)

    0-1 year
    1-2 years
    2-3 years
    3-4 years
    4-5 years
    5-6 years
    6 or more years

2. Have you had formal proofreading instruction? (either in school or on the job)

    Yes

    No

3. Do you wear corrective lenses when proofreading? (either contacts or glasses)

    Yes

    No

    Sometimes

4. Do you enjoy working with the computer?

    Yes

    No

    Sometimes

5. Are you physically comfortable while you are working with the computer?

    Yes

    No

    Sometimes

6. When you work with the computer, is there a glare on your computer?

    Yes

    No

    Sometimes

7. When you work with the computer, do the colors on the computer screen bother your eyes?

    Yes

    No

    Sometimes

APPENDIX J

ANSWER SHEET

i.d. number _____

Answer Sheet

<u>Directions</u>: Place corrections for each document in the approriate column. Put only one correction per line. You may not need to use all of the lines that are provided. Keep this sheet until the researcher calls for you to turn it in.

Document 1 (report)	Document 2 (memo)	Document 3 (letter)
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.
7.	7.	7.
8.	8.	8.
9.	9.	9.
10.	10.	10.
11.	11.	11.
12.	12.	12.
13.	13.	13.
14.	14.	14.
15.	15.	15.
16.	16.	16.
17.	17.	17.
18.	18.	18.
19.	19.	19.
20.	20.	20.

APPENDIX K

ERROR ANALYSIS SHEET #1
NUMBER OF ERRORS FOUND

Document _____

I.D. Number	Hardcopy Report			Hardcopy Memo			Hardcopy Letter			Softcopy Report			Softcopy Memo			Softcopy Report		
	found	properly corrected	times proofread	found	properly corrected	times proofread	found	properly corrected	times proofread	found	properly corrected	times proofread	found	properly corrected	times proofread	found	properly corrected	times proofread
Total																		

APPENDIX L

ERROR ANALYSIS SHEET #2
TYPES OF ERRORS FOUND

Type of Errors Found/Type of Errors Properly Corrected   Document _____

I.D. Number	Omissions					Additions						Transpositions		Other	
	letters	important letters	characters	space after words	space after commas	letters	important letters	words	space in words	space before commas	stray letter	letters	words	misstrokes	substitution
Total															

APPENDIX M

DESCRIPTIONS OF CLASSES
PARTICIPATING IN THE STUDY

The following course descriptions are taken from the 1988 Program of Studies for Business Education:

1. Secretarial Administration I

This is a one-year, double period course. Major emphasis is placed on using a shorthand system and developing transcription skills. Students are taught touch operation of calculating equipment and are introduced to other equipment used in business offices. Document preparation, office procedures, recordkeeping, stenography, communications, beginning computer applications, and employability skills are included in the course.

2. Secretarial Administration II

This is a one-year, double-period course with primary emphasis on refining stenographic skills developed in Secretarial Administration I. Units of instruction include financial records, records management, mail processing, oral and written communication, information/word processing, calculating machine operation, office procedures, human relations skills, and machine transcription, as well as keyboarding and shorthand speed and accuracy development.

3. Office Specialist II

This is a one-year, single period course with Cooperative Office Education (COE) or a double-period course without COE. Units of instruction include financial records, records management, mail processing, oral and written communication, information/word processing, calculating machine operation, office procedures, human relations skills, machine transcription, as well as keyboarding speed and accuracy development.

APPENDIX N

MATERIALS CHECKLIST

Class: _____

Materials Checklist

Item	Number
a. pencils	a.
b. dictionaries	b.
c. students' disks	c.
d. back-up disks	d.
e. background information sheets	e.
f. instruction sheets	f.
g. hardcopy documents	g.
h. answer sheets	h.
i. printer paper	i.

APPENDIX O

ERRORS IDENTIFIED IN THE REPORT

i.d. number _____

COMPUTER PROGRAMS

By Gordon MacIntosh

There is a great diference between running a program,and writing a program. Running a program is simpkle; writing a program for a computer requires a lot of work.

WRITING A PROGRAM

First, you must learn a computer language. Computers have their on languages--Basic, Fortran, Pascal , and so on.

Second, computersare exacting and precise. One charactee out of place can cause a program not two run.

Third, the programmer never knows quite how the program in going to turn out until it it is finished.

RUNNING A PROGRAM

Computer pro grams are easy to run. All do you is put a disk in a disk dirve--or a cassette in a cassette playyer--and push a button. Programs that are easy to learn are called "user-friendly.

The number of time(s) I read through this document was _____.

APPENDIX P

ERRORS IDENTIFIED IN THE MEMO

i.d. number _____

MEMORANDUM

DATE: March 14, 1988

TO: All Staff

FROM: Brian Layman, Dean

SUBJECT: Establishment of Task Force

At the sugestion of numerous staff members, the university is
pursuing the idea of purchasing a computer system for general
use. Members of then staff with whom I have talked have shown
many applications for computer useage in thier daily work.

A task force if interested staff members is being formed to
conduct a more through study of the needs of the the staff.
Based on its findings , the task force will then make
recommendations for the purchase of a computer system and
software. I need to who know among the staff is interestad in
serving on the task force.

Responsibilkities of the task force include the following: (1)
assessing the staff's needs, (2) gathering information about
computer systems, (3) evaluating the software available, and (4
making recommendations tothe purchasing agent and me.

If you are interested in actively re searching this topic and
meeting this challenge, please send me a memo indicating your
interest.

The number of time(s) I read through this document was _____.

APPENDIX Q

ERRORS IDENTIFIED IN THE LETTER

i.d. number _____

1760 Asbury Street
Indianapolis, IN 46203-3952
March 14, 1988

Miss Kimberly Etheridge
Personel Director
Merritt Electronic Company
7643 Evans Avenue
Gainesville, FL 32612-9876

Dear Miss Etheridge:

I was surprised to learn than Mrs. Melanie Cooke has used my
name as a refference on her application for a job with your
company.

Mrs. Cooke worked with me for about three months. During time
that her work was never up to to the standards demanded by
business. My major criticism of her as an em ployee centered on
her carelessness and inefficiency in her work.

Mrs. Cooke freqeuntly arrived late or left early. She was
careless in her personal appearance , and her overall attitude
was not good. After speaking to her on severajl occasions about
her lack of efficiency andthen noting no improvement, I was
forced to dismiss her.

Had Mrs. Cooke requested permission to use my name as a
reference, I would have declined; but since she did not, I have
now alternative but to give he an umsatisfactory recommendation.

Sincerely yours,

Walter T. Hartsell
General Manager

The number of time(s) I read through this document was _____.

The vita has been removed from
the scanned document