AN ABSTRACT OF THE THESIS OF

SHIRLEY MABEL WONG for the D. Ed.
(Name) (Degree)

in EDUCATION presented on April 12, 1971
(Major) (Date)

Title: A STUDY TO COMPARE THE EFFECTS OF THREE DIFFERENT METHODS OF READING COPY WHEN PROOFREADING STRAIGHT PARAGRAPH COPY MATERIALS BY FIRST-YEAR TYPEWRITING STUDENTS

Redacted for Privacy

Abstract approved _____
C. T. Yerian

An experimental study was conducted with beginning typewriting students to investigate the effects of two variables in proofreading straight copy paragraph materials in the independent method of proofreading. One was the influence of repetition which was examined through the use of three different methods of reading. The second was the effect of the use of paper of different colours as background context defined as illuminating, neutral, or unilluminating in terms of whether colour was an aid or hindrance to readability. A comparison of the level of inaccuracy in proofreading was made between seven types of errors. These include:

1. Doubling of small words or of syllables within a word
2. Omission of a letter within a word
3. Omission of one of a pair of doubled letters
4. Transposition of letters within a word
5. Spacing errors
6. Substitution of words
7. Transpositions of words

The influence of error location was investigated through an analysis of the mean percentage inaccuracy score by vertical and horizontal quartiles.

Method

Two independent groups composed of 172 and 171 subjects were randomly selected from beginning typewriting classes in two urban school districts. Each group wrote three criterion tests in which 14 errors (2 each of 7 error types selected) were loaded. One group wrote tests printed on white paper, defined as neutral, while the other completed tests printed on paper of colours defined as illuminating, unilluminating, and neutral respectively. These tests were equivalent in readability level and error load to each other, and to the materials used in beginning typewriting classes. The effect of repetition was investigated by asking subjects to proofread with 0, 1, and 2 repetitions on three tests that were administered on three

successive days. Performance was measured in terms of time, total errors, number of errors by type, and the mean percentage of errors by location. The significance of the differences between means was determined through an analysis of variance and F tests at the one and five percent levels.

Findings

1. Colour does not affect the proofreading time rate. The use of white or neutral paper produces a higher accuracy level in proofreading over coloured paper in terms of total errors, mean errors by type, and mean percentage of errors by vertical and horizontal location.

2. The proofreading rate recorded in relation to the frequency of repetition in reading was 1.03 minutes per 100 words for 0 repetition, 1.05 minutes for 1 repetition, and 1.33 minutes for 2 repetitions. One repetition yielded the highest level of accuracy in terms of total errors, error type, and vertical and horizontal location of errors.

3. The inaccuracy level recorded in terms of mean total errors was 39%, 30%, and 31% for 0, 1, and 2 repetitions respectively, indicating that a single reading is insufficient and a third reading does not assist a reader in finding errors that were undetected with 1 repetition.

4. The rank order of inaccuracy of the seven types of errors are:

1. transposition of words within a sentence
2. spacing errors - omission and extra spaces
3. substitution of one small word for another
4. omission of one of a pair of doubled letters
5. omission of a letter within a word
6. doubling of small words or of syllables within a word
7. transpositions of letters within a word

5. Errors located on the left half of the page and on the bottom half of the page are more difficult to detect.

A Study to Compare the Effects of Three Different Methods of Reading Copy When Proofreading Straight Paragraph Copy Materials by First-Year Typewriting Students

by

Shirley Mabel Wong

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Education

June 1971

APPROVED:

Redacted for Privacy

Head of Departments of Business Education and Secretarial Science
in charge of major

Redacted for Privacy

Dean of Graduate School

Date thesis is presented April 12, 1971

Typed by Opal Grossnicklaus for Shirley Mabel Wong

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

A STUDY TO COMPARE THE EFFECTS OF THREE DIFFERENT METHODS OF READING COPY WHEN PROOFREADING STRAIGHT PARAGRAPH COPY MATERIALS BY FIRST-YEAR TYPEWRITING STUDENTS

I. THE PROBLEM

Introduction

The establishment of universal, compulsory education at the secondary level is one of the major developments of historical significance of the 20th century in our nation. The descendants of the immigrants who settled in North America from the turn of the century to the end of the 1930's have followed the belief that educational attainment was the surest method of personal advancement. If our world today can be described as "advanced, scientific and technological," it should be acknowledged that this development was preceded by the growth of a literate nation. The astonishing rate of growth of our "New World" of knowledge was greatly influenced by the creation of a vast pool of talent where individual abilities were permitted to emerge through easy access to education.

The expansion of information which we witness today views the interchange and dissemination of erudition at electronic rates of speed as commonplace. This has been attainable because reading

literacy permeates every aspect of our lives. We begin our education by learning to read, and we in turn use this tool for the continuation of learning throughout our lives.

With the amplification of electronic data processing, the quality and quantity of information available for business and personal use has increased tremendously. It has been estimated that man's accumulated knowledge doubled during the decade of the 1950's and that of the 1960's may record a geometric increase. Accompanying this proliferation, we have witnessed a speedup in the processing of information to the point where the published rate of transference is difficult to comprehend by an individual. If our society continues to expand the use of available data for decision making at the present rate, the need for accuracy in the compilation, storage, and dissemination of information becomes more critical than ever.

Today the typewriter is the most readily available tool for the recording of ideas or information that will be published and used by people other than ourselves. The utilization of pen and pencil will probably continue to decline, not only because the idiosyncrasies of individualistic, undecipherable handwriting demand it, but also because typewritten material permits sizeable paper space savings. The practice of using the typewriter for personal communication is growing more evident--even at the elementary school level. Undoubtedly we are witnessing the evolution of the use of the typewriter

as an assisting factor in the learning of language arts. As typewriting courses become more available in the intermediate grades, then the advantages of using a typewriter will become even more significant.

On the vocational side, the importance of the secretarial worker cannot be overestimated. No scientific breakthrough, business decision, or governmental proclamation can be announced until the secretary has completed her work. Raw data may reach her desk in the form of handwritten sheets, the dictation disk or shorthand notes, and her vital function is to organize the material into disseminative form.

The need for accurate proofreading is critical as she checks her work against the array of sources from which she is working. How well one can detect errors is a question with many ancillary problems that merits examination.

Problem

The problem of proofreading probably originated simultaneously with the development of written symbols for the purpose of communication. Linguists state that writing began about six thousand years ago, but there is no evidence through which we can study its origin.

The process of proofreading usually is defined as the reading of manuscripts or other forms of written matter for the purpose of detecting and marking errors. Sometimes the correction of the

errors found is assumed. Reading in itself is a complex procedure involving the perception and recognition of visual stimuli which cause the reader to recall meanings which have been integrated into one's knowledge through past experiences. Moreover the symbols which serve as stimuli should evoke the meanings which the writer intended. In the development of reading skill, the student is expected to increase his speed as well as comprehension.

Although the major learning task of children during the primary years of education is the acquisition of reading ability, the exact nature of the process is as yet unknown. Numerous studies have been published and the research continues, but the process by which visual stimuli are interpreted in our brain persistently eludes investigation (8, 74). This is further discussed in the second chapter, but at this point a parallel can be drawn to the eating of a vegetable soup whereby we can describe our knowledge of the end product with a greater degree of accuracy than the awareness of the component parts. In reading, unless the errors are gross or present in great numbers, we readily accept what we see, by-passing the mistakes contained therein. When we add the factor of error detection to the reading task, it becomes more understandable why the person who proofreads accurately consistently is the rare exception, in spite of common expectations to the contrary.

Man's inability to proofread accurately is well documented in spite of the limited amount of research that has been conducted.

The first intensive study carried out by Crosland (24) in 1924 reported that none of the subjects could detect errors with total accuracy. This defect is surprising because all the subjects were either vocationally involved as typographers, or studying or teaching at the college level.

This incompetency was confirmed in an extensive survey conducted by Ewart (30) who classified the types of undetected errors. Among the 2538 subjects which included junior secondary, secondary, and college students, business education teachers and professional secretaries, only one reader was able to find all errors on the criterion test.

In a study that attempted to determine the relationship between achievement, interest, aptitude and IQ to proofreading ability, Staples (100) found that none of his subjects read with 100 percent accuracy. One hundred freshman and sophomore college students and 40 secretaries were able to detect only approximately 25-50 percent of the 400 errors written into the proofreading tests.

Studies conducted in other subject areas (44, 66, 80, 83) have reported varying levels of substantial inaccuracy. Both Staples and Crosland stated that the subjects' proofreading proficiency was much

lower than their expectations at the time their studies were formulated.

Importance of the Problem

The maxim, "mistakes are costly," has become a hackneyed phrase, but the truth contained therein remains. The transpositions of figures in sales contracts have resulted in lawsuits. The typist who omitted the comma between the first two names when incorporation documents were being prepared for the investment firm of Merrill Lynch, Pierce, Fenner & Beane attests to the permanency ofcertain types of mistakes that can only be rectified at great financial expense. The cost of undetected errors probably will increase as business and industry increasingly turn to electronic data processing methods to handle their paper work. Crawford (22) notes that there will be an increase in the amount of handwritten work and technical materials which the typist must copy. The pace of work also is expected to quicken as the typist must keep pace with expensive equipment which must be utilized as close to capacity as possible if economies are to be realized.

Management in business and industry is aware of the need for proofreading. The time required for the checking of work is already integrated into the work routine and the worker who considers a job finished even though it has not been checked, eventually acquires a

reputation for carelessness and unreliability. Supervisors accept the fact that everyone makes mistakes, but they also expect the employee to find and correct these errors. The American Tobacco Company has stated that it considers its correspondence "as representative of its image as its products and service" (85).

The habit of checking for errors is not only inculcated in job training for entry employees, but also one that is taught to all students by teachers in every subject field. This habit is cultivated from the beginning years of every student's education because consistent production of correct work requires a systematic review of one's output for errors. Although all of us recognize and acknowledge the need for accuracy, we also know that errors continue to be undetected in spite of the fact that a conscientious effort to proofread may have been made.

At present, inaccuracy in proofreading by students in typewriting is attributed to carelessness, lack of knowledge, inadequate motivation, or even dishonesty (7, 20, 97)--all failings which fall within the scope of responsibility borne by the students. Yet the publications authored by experts (24, 30, 34, 37) report that mature, well educated adults also lack proficiency in proofreading. These statements suggest that our traditional concepts and attitudes towards proofreading are worth re-examining.

At this time, there is an extremely limited amount of information about the nature of the process and the conditions which accompany proofreading. Until the gaps in knowledge about the process of reading have been closed, the questions concomitant to proofreading are likely to remain unanswered.

The foregoing also is applicable to tested, validated techniques that may be used in the instruction of proofreading. While articles can be found in business education journals which discuss different methods, these methods have not been investigated through systematic research. Thus the teacher who seeks proven methods of improving proofreading proficiency has little available in tested resources that can be used with confidence.

The problem is compounded by the fact that the limited amount of research reported conflicting findings. For example, the factor of time which was investigated by three of the major studies published the following findings:

1. Ewart: ". . . extra time spent in proofreading did not significantly decrease the number of errors" (30, p. 27).
2. Crosland: ". . . some degree of negative correlation exists between the inaccuracy score and the amount of time spent in reading as shown by these group ranks" (24, p. 33).

3. Staples: "Proofreading rate is the best single predictive factor for determining proofreading efficiency" (100, p. 122).

All of these factors indicate that the subject of proofreading can be considered as virtually unexplored territory for the purposes of scientific investigation.

The Purpose of the Study

Although some hold the view that proofreading ability is innate and immutable (37), studies in perception appear to indicate that a student's inability to detect errors may be explained on a psychological, physiological, and neurological basis (22, 42, 45). In addition, research (38, 44, 79) in specific techniques to improve language arts abilities indicate that systematic instruction could raise the proofreading proficiency of the students. After considering the foregoing and reviewing the literature, this investigator undertook this study subscribing to the latter view that the question of proofreading is a suitable subject for inquiry for the purpose of improving instruction in this problem in the field of typewriting.

Two basic methods of proofreading usually are taught in typewriting clases. In the proofreader-copyholder method, a student works with a partner. The proofreader looks for errors in the work while the copyholder reads the original material aloud. In the

individualized or solitary method, a student reads alone comparing the work against the original, letter by letter, or word by word.

The purpose of this study is to obtain data about some of the conditions which accompany proofreading when students are reading to detect typographical errors in the individualized method in beginning typewriting classes. Data will be collected through the administration of three criterion tests for the purpose of undertaking an assessment of proofreading efficiency in relation to the following factors:

1. In view of the inaccuracy levels recorded by subjects in other studies the factor of repetition is to be considered in the independent method of proofreading. This study will examine the question of the number of repetitions of reading for typographical errors that give rise to the highest level of accuracy out of the number selected for use. In this experiment the number of repetitions used will be three--0, 1, and 2. The measure of reading accuracy will be the scores of the subjects obtained following the administration of three criterion tests that are equivalent in length, readability, and error load.

2. A review of the types of errors that have been undetected most frequently in past studies will be undertaken, and these will be selected for use in this experiment. The errors undiscovered by the subjects will be analyzed as to type and rank order of difficulty.

3. Paper of different hues with varying tints and shades are being used increasingly in the classroom. This study will examine the question whether the use of paper of different colours (which changes the background context of the material read) affects proof-reading proficiency.

4. An ancillary factor to be investigated is a variable in the location of errors. Is there a relationship between the vertical and horizontal location of errors and reading accuracy?

5. Is there a relationship between IQ score, grade level of subjects and time used in reading the criterion tests and the error detection score?

These factors may be classified as independent and dependent variables:

Independent Variables

1. Repetition of reading - 0, 1, and 2 readings
2. Types of errors used in criterion tests
3. Number of errors used in criterion tests
4. Types of colours used in paper of criterion tests
5. Location of errors in criterion tests

The following independent variables will be used as control factors:

1. IQ scores obtained from the Progress Record Cards of the subjects in terms of a seven-point scale. (The Progress Record Card is the official record of each student's scholastic progress in British Columbia.)
2. Grade level of subjects

Dependent Variables

1. Total errors undetected
2. Type of errors undetected
3. Time required to complete each test
4. Location of undetected errors in terms of vertical quartiles
5. Location of undetected errors in terms of horizontal quartiles

Limitations

1. The study will be limited to a sample of students enrolled in the beginning typewriting course in junior secondary schools located in the school district of Burnaby, British Columbia, and secondary schools in the district of Vancouver, British Columbia, for the 1969-70 academic year. The sample is deemed to be representative of urban students enrolled in a beginning typewriting course.

2. The three criterion tests were constructed by the investigator to be representative of the straight-copy typewriting materials

that beginning typewriting students encounter in their daily work, and are equivalent in terms of subject content and readability level as measured by the Flesch formula.

3. After the first random sampling of the Vancouver schools to establish the experimental group, one school, Kitsilano, declined to participate in the study. Ill health of faculty members was stated as the reason for the refusal. Subsequently the table of random numbers was used again to select an alternative school, Killarney.

4. The three senior secondary schools of Burnaby were not included in the population. This was an arbitrary decision made by the investigator on the basis that since only Grades 11 and 12 students are enrolled, the composition of the Typing 9 classes (the first course in typewriting) would not be representative of the defined population where most students select beginning typing before the final two years of their high school programs. During the 1969-70 school year only two of the three senior secondary schools offered the Typing 9 course with one class enrolled in each school respectively.

5. In the comparison of the two experimental groups for differences arising from colour context (the use of different coloured paper as opposed to white), the assignment of the subjects to each of the two treatments was not done at random. Burnaby was selected for the first group and Vancouver the second. Hence the statistical

control of individual differences through the use of a covariate was recommended and in this study the use of the IQ scores of the subjects was found suitable in establishing the basis for the proper comparison of the two groups.

6. The tests for the first experimental group (coloured paper) were administered by the subject teacher who was normally in charge of the class, while the tests for the second experimental group (white paper) were administered by the heads of the Commercial Departments of the respective schools.

7. At the onset of the experiment a test administrator reported that in isolated instances the subjects were not following the reading directions. It was decided that a personal interview would be held so that each test administrator would be made aware of such a possibility and that each subject should be reminded about the directions to be followed. Test administrators did not relate any further difficulties. It also was decided on the recommendation of the Research Department of the Vancouver School Board that the investigator should administer the tests to individual subjects so that the scores obtained could be compared to those of the experimental groups. This procedure was followed for six cases, but subsequently it was found that this data could not be used because the selection of the subjects had not been made at random.

Assumptions

1. Any significant statistical differences between the three procedures of reading copy are the result of real differences in the variables under comparison.

2. The subject matter instruments used in this study validly and reliably measure the students' achievement in proofreading.

3. The participants in the study will proofread according to the directions given on the criterion tests and by the test administrator.

4. Any difference in the performance of the subjects is within the range of sampling error, or controlled through statistical treatment.

5. The beginning typewriting course designated Typing 9 in Burnaby and Vancouver is representative of those found in other urban areas of British Columbia.

Definition of Terms

Proofing, Proofreading: The reading of written or typewritten materials for the purpose of finding errors of typography, organization, and of thought content.

Proofreading ability: Differentiations in levels of skill in detecting errors.

Proofreading efficiency, Proofreading proficiency: The ability to detect errors with a high percentage of accuracy.

Proofreading rate: The number of words read each minute when detecting errors.

II. REVIEW OF THE LITERATURE

The Need for Proofreading Proficiency

If written communication is to be successful, the completion of accurate proofreading is implied. The need for proofreading proficiency spans both the personal and vocational aspects of our lives, from the writing of cheques for household expenses to the review of a complex program by a systems analyst. From our earliest years we are told to check our work, for our self-concepts of abiliity deteriorate when we are constantly criticized for carelessness. Our reputations are largely dependent upon the continuing accuracy of our output. Although skill in proofreading is needed in every subject area, it would appear that it has been neglected throughout the curriculum. Proofreading skills acquired by students have been incidental rather than deliberate.

In the field of language arts, Wittick expresses the view of many English teachers (38, 44, 51, 61, 84) when she made this statement in a study involving compositions at the elementary level.

> Proofreading should be taught systematically and sequentially. Textbooks and courses of study in the language arts give lip service to the idea, but how many of them give enough concrete, step-by-step help to the classroom teacher who is used to saying, "Proofread your papers before you turn them in!" [1]

---

[1] Wittick, 1960. (107) p. 300.

Business educators also have found that proofreading deficiencies are commonplace (7, 9, 19, 20, 21, 45, 62, 76) in their subject area.

Hamden Forkner, the well known author of business textbooks said:

> I wish I had learned the importance of proofreading. It seems at school that we were more concerned about getting a job done than we were certain that it was correct. We depended upon the teacher to check our work and when it was checked we merely looked at the number of errors she had found and did nothing further about them except to worry about the grade we would receive.[2]

A business teacher, D. A. Young writes:

> Looking back on my own secretarial experience, I remember that I did not learn the techniques of proofreading in the classroom. Although I was enrolled in the business curriculum at both the high school and college level, I did not become aware of the importance of proofreading until the first morning of my employment as a secretary. Several of the twenty-five letters I transcribed were returned to me because of uncorrected errors. From this embarrassing experience, I have learned the importance of taking precautions so that students learning the skill of typing are prepared to do more than just type.[3]

The proofreading ability of teachers is continually assessed by students and cannot be taken for granted. One implication of inaccurate checking is articulated in a question posed by Foster:

> Have you ever thought of the silent impression you make on your pupils when they find an error you didn't discover? I say "silent" because the pupils are too polite or wise tocall you to their desks and ask why you failed

---

[2] Forkner. 1958. (32) p. 7.

[3] Young. 1968 (111) p. 4.

> to check their error. Yes, they've told me of the comparative checking abilities of other teachers. And, if I were so minded, I could a tale unfold about uncaught errors in papers by typing teachers who have boldly claimed they can easily bring their pupils to check their work 100%.[4]

Business and industry have long decried the necessity for accuracy, not only because errors are costly in terms of labour and time expended, but also because of the effect on morale and damage to interpersonal relationships when the necessity to assess responsibility for errors occurs repeatedly. A study to determine how transcribers spend their time was undertaken by Jester (60). He found that 25 percent of the time was spent in proofreading, erasing and correcting errors. Only striking the keys on the typewriter occupied a greater portion of their time (38%).

The American Tobacco Company believed that accuracy and uniformity of style in its correspondence were so important that it established a proofreading division (86). Ten college graduates with majors in English or Journalism check content as well as setup of every letter. The division also acts as a reference section that advises secretarial workers as problems arise during the course of their work. In the long run the company expects the expenses of this department to be more than covered by the cost savings effected by a decrease intranslation costs and time spent in typing technical reports and re-typing letters.

---

[4]Foster, 1938 (34), p. 451.

Management's growing preoccupation with cost control will continue to increase as expensive electronic data processing equipment proliferates in business. Crawford (23) anticiptates these implications to which business teachers must adjust curriculums:

1. More typewriters that use magnetic tape.

2. An increase in the amount of handwritten copy from which the typist must work.

3. An increase in technical copy--numbers must be stressed in typewriting.

4. More pressure in work as typists must keep up with expensive machines which must be used as close to capacity as possible to be economical.

5. Proofreading ability is mandatory.

The Visual Mechanism and Physiological Aspects of Reading

The Role of the Eyes in Vision

Sight is one of the physical attributes of our lives which we tend to take for granted until the visual system deteriorates or ceases to function. At that time we are better able to evaluate the phenomenon of seeing and to appreciate our dependency on our sense of sight for our general orientation to events and things around us.

Our eyes are the physical organs which we associate with the process of vision. Yet they are only one part of the total physiological, psychological and neurological system which is activated when we "see." The eyes are the receptors which provide the brain with information--messages which are coded into neural activity in the form of chains of electrical impulses. The brain responds with patterns of activity representing objects or images; and which to the brain is the object although no internal picture is involved. Thus, in spite of the fact that our eyes have often been described as, and compared to a camera, Gregory (47) warns us to avoid the mistake of comparing the two analagously. For the eyes do not produce pictures in the brain; it is the process by which eyes and brain adapt information received and reconstitute it through the language of the brain into meaningful experience that constitutes the process of vision. The eyes are the connecting link between objective reality and visual perception.

The structure of the retina plays a vital role and is responsible for different types of illusions and other visual phenomena. The place where the optic nerve enters the eyeball and begins to spread out is blind. Light which falls upon this blind area is invisible, but binocular vision obviates this problem because these areas do not overlap. Hence the viewer is unaware of the missing portions of the image.

The bacillary layer of the eyes consists of rods and cones. Under low intensities of illumination such as moonlight, only the rods are operational. At intensities of illumination such as twilight, the cones function. The shortest distance between two points which is visible at five inches is .001 inch and two cones must be stimulated. Irregularities found in the disposition or operation of the cones and rods are responsible for visual illusions such as straight lines appearing curved to the viewer.

The fovea centralis is the point of distinct focus and visual acuity. It is the part of the retina located on the optical axis of the eye. It is a slight depression much thinner than the remainder of the retina and is inhabited mainly by cones. Tests have shown that fine detail cannot be seen outside of the area occupied by the fovea (74). A person tends to focus an image onto the fovea when one wishes to view an object distinctly either by turning the head or moving the object. A yellow pigmentation found in the fovea accounts for one's ability to discriminate colours. As one views different colours, changes in the colour in the pigmentation can be observed. Without the fovea one might see equally well over a large area, but could not focus attentively on anything.

During periods of consciousness, our eyes are never at rest. Involuntary movements are taking place constantly. Fatigue may be responsible for illusions such as after-images, although experiments

(16) indicate that the muscular movements of the visual system are seldom taxing to the viewer in relation to the continual activity taking place. Carmichael and Dearborn describe this condition:

> . . . there is excellent evidence that the extrinsic muscles, like most other skeletal muscles, maintain their activity by a mechanism which protects them from exhaustion. Under normal conditions, the various fibers in a muscle support the load by turns, so that each individual fiber works for a small fraction of the time. It would seem that the eye muscles as total structures can "rest as they work," a recuperative rest period which is adequate for restorative purposes occuring between bursts of activity. . . It must be emphasized however, that this absence of "fatigue" must apply to the whole visual mechanism, including retina and nervous system as well as eye muscles. No part of the visual system exists for itself.[5]

The Process of Vision

Sight occurs when a narrow band of the electromagnetic energy spectrum stimulates the sense receptors located in the retina. Scientists generally agree that radiant energy exists in the form of undulations of electromagnetic disturbances capable of travelling through empty space at great velocity. Radiant energy is usually described in terms of wave length, and oscillations between approximately 350-750 millimicra stimulate the visual mechanism. The radiation of these oscillations emanates from some source of energy such as the sun or fluorescent lamp, and may reach the eyes directly or be reflected from some surface.

---

[5] Carmichael and Dearborn. 1947. (16) p. 36.

Light is then focused through the various optical media to the sensitive cells located in the retina. Here an image which is related in an approximate geometrical manner to the shape and gradients found in the surfaces from which the radiant energy has been reflected is formed. The image focused is inverted because the eye as an optical mechanism is reducible to a single lens. This image causes no difficulty because the viewer is unconscious of the inversion. The images of objects found in the right half of the field of view focus upon the left half of the retina, while the left half focus on the right. Correspondingly the upper half of an image focuses on the lower half of the retina and vice versa. When light strikes the retina the impression is referred back along the ray-line to its original place in space.

The ability of the muscles to adjust to changing conditions is described by Luckiesh and Moss:

> For every voluntary act of sight there are 2 adjustments of the eyes, namely focal and axial. In the former case the ciliary muscles adjust the lens in order to produce a defined image upon the retina. In axial adjustments the two eyes are turned by certain muscles so that their axes meet on the object looked at and the images of the object fall on the central-spots of the retina. These take place together without distinct volition for each, but by the single voluntary act of looking. Through experience the intellect has acquired a wonderful capacity to interpret such factors as size, form, and distance in terms of the muscular movements in general without the observer being conscious of such interpretations.[6]

---

[6] Luckiesh and Moss. 1942. (73) p. 33.

As light falls upon the retina it initiates chemical and electrical changes. These stimuli-induced changes in turn activate the lower and higher visual centers of the brain by the way of the optic nerves and optic tracts. This process of differential reflection and absorption of radiant energy and its sequential stimulation of the total visual mechanism constitute the basic aspects of all types of vision. This includes brightness, colour, and pattern vision, visual acuity and stereo-depth or tri-dimensional vision.

Physiological Factors in the Process of Reading

Reading is a remarkable visual skill and one that is relatively new in the sense that it developed after the invention of writing. Groups of abstract symbols--letters--which bear no resemblance to the meaning they deign to convey, are absorbed and reconstituted into meaningful experience by the individual who has acquired reading skill. The ability of the eyes to concentrate for a lengthy period of time on the small areas of space represented by a page in a book is an amazing feat of discipline. Moreover the eyes must not merely attend the total area exposed in a haphazard fashion, but must follow the lines of print in a predetermined pattern. This control which we learn to exercise over the movement of our eyes is unique. We have not progressed to the same level of development in the use of our other sensory systems.

When one learns to read, the proper movement of the eyes is trained through practice in the same manner as the proper movements are acquired by the student of swimming or of typewriting. One important difference however, exists. As the beginning swimmer or typist progresses, he is aware that he is learning muscular control, whereas in reading, the tyro is typically unconscious of the movement of his eyes.

In the process of reading, the eyes jump from fixation pause to fixation pause along a line of print. During a fixation the eyes are held relatively motionless for a fractional period of time. The simultaneous contraction of sets of opposing muscles stabilizes the eyes during this pause although they are not held absolutely still. The retina is thus exposed to a steady pattern of focused light differentially absorbed and reflected from the letters and/or symbols found on a page or other surface. As the eyes move the lens adjust quickly to changes in the fixation point, permitting the reader to perceive the material exposed.

At the completion of a fixation, the saccade or saccadic movement advances the eyes to the next portion of the printed line. This jerky motion is originated by the contraction of one set of muscles, the agonists. It then proceeds under its own momentum until it is stopped by the contraction of an opposing set of muscles, the antagonists. Saccadic movements do not provide clear images, but instead

streaks and jerks. The reader is unconscious of this temporary disorientation however, because of the speed of the movement. At the end of a line the eyes make a saccade to the beginning of the next line. This movement is referred to as a return sweep since the length of the jump is longer and the eyes move in an opposite direction.

The direction which the eyes are trained to move will depend upon the cultural pattern of writing which is used in the society that one lives in. In our society print follows a left-to-right orientation, but in others, words are written from right to left or from top to bottom. In reading the eyes advance by fixation pauses interspersed with saccadic movements until a return sweep brings the next line into focus. Occasionally however, the eyes will regress and move backwards instead of forward during a fixation. These corrective movements permit the reader to re-fixate on material. These movements are made with greater frequency by poor readers than by proficient ones and it is assumed that the reader has not comprehended or "misread" the material. The number of regressions tends to decrease as the age and reading experience of an individual increase. Generally both eyes move in the same direction or make "conjugate" movements during fixations, saccades, return sweeps and regressions.

Records of the reading pattern of each eye as both work simultaneously show vergence movements (16). There is a tendency for

the eyes to diverge during each fixation and to converge during a return sweep. The convergence represents a one degree shift of the eyeball from the line being read.

During a saccade the eyes move about 2/5 of an inch in approximately 15-20 milliseconds. The time factor is relatively constant where the length of movement is the same for each individual. Although a reader may make conscious saccadic movements at any time by shifting his focus of attention from one area to another, he cannot consciously control the movement of the muscles that will speed up or slow down the motion. The reader is rarely aware of the saccadic movements he makes and one cannot count the number made while reading a line of print. The number of saccades required depends upon the number of fixations and regressions made.

The length of a fixation tends to decrease with age (16). The duration of a pause is relatively constant and is not affected by conditions which affect the frequency of fixations. The length of fixations averages about 660 milliseconds decreasing to 210 milliseconds for college freshmen who are proficient readers and 260 milliseconds for poor readers. Studies in eye movements report that the duration of fixations remains relatively constant at approximately 250 milliseconds after a child reaches the age of 10 or 11. Thus improvement in reading skill would be a variable influenced by the frequency rather than the duration of the fixation pauses.

The relative time spent in each type of movement can be calculated. Ninety percent or more of the time is spent on fixation pauses and ten percent on saccadic movements including return sweeps. Thus the ocular mechanism operates at a remarkable efficiency level since 90 percent of the time is utilized in productive effort while only 10 percent is occupied by the functioning of the system itself.

The eyes however, are only one constituent of the total visual structure. The role and effects of the other components are unclear (8, 16, 47, 72, 103). Undoubtedly the neuromuscular mechanism and the central nervous system affect the general efficiency of a reader in the process of perception. In addition, the reading pattern may be influenced, modified or determined by conditions in the external environment such as noise and lighting. These may act upon the reader and interact among themselves so that isolation of each variable for the purpose of experimental study becomes extremely difficult. Bond and Tinker, American experts in remedial reading have decried the accentuation on eye movements as a major influence on reading efficiency. They chide:

> We assert that this unfortunate emphasis upon the mechanics of eye movements tended to direct attention to the peripheral factors as determinants of the reading performance rather than to the important central process of perception and comprehension.
>
> Ineffective eye movements do not cause reading deficiency. Ample evidence in research studies indicate that eye-movement patterns during reading are symptoms of the

> central process of perception and comprehension. They merely reflect the ability of the reader to interpret what he sees. Those changes in eye movements which occur with improved reading do not mean that the eye muscles coordinate better than before. Oculomotor behavior is very flexible and adjusts readily to any change in the perceptual and assimilative processes involved with reading.[7]

Studies in eye movements (16) have provided tentative theories about the relationship between reading comprehension and the frequency, location, and duration of fixation pauses. These include:

1. The reading of familiar phrases requires very few pauses.

2. Proper names and titles require more fixations. There is a tendency for the eyes to avoid capital letters.

3. The eyes do not stop at the same point in space for each line of print.

4. The eyes do not fixate on any special part of a word, type of letter or length of word.

5. The eyes do not fixate every letter or every word, or even a whole phrase in its visual space. This suggests that the reader searches for cues for comprehension and when satisfied, progresses to the next portion. Carmichael (16) notes that this may be one factor responsible for proofreading errors because an incorrectly spelled word is seen as correct because it is familiar.

6. Typographical factors may provide cues which satisfy the reader's need for comprehension leading him to believe that he is

---

[7] Bond and Tinker. 1967. (8) p. 235.

ready to continue. These include the configuration of a word, the dominant letters, the first and last letters of words, and letters adjacent to the fixation point.

7. In reading short lines of print the context of the line above and the line below contributes to the comprehension of the line being read. In long lines of print the adjacent lines may interfere since the materials are not closely related.

8. The areas adjacent to, but outside the field fixated by the fovea, is known as the range of indirect vision. The range is longer for isolated letters than for words. This suggests that letters in groups may mask each other, or the perception of one letter interferes with the perception of another. Thus in reading, the space "read" would consist of an area of clear vision complemented by a surrounding expanse of less clear, but still useful vision.

9. The context of previously fixated material may lead the reader to expect some logical sequence to follow. Thus certain words or phrases may be anticipated and only partial or abbreviated cues are needed for recognition.

10. Proofreading requires a larger number of fixations than any other type of vision. Lasky (69) reported that the span of foveal vision is small, ranging from six characters for 6-point type to four characters for 10-point type.

Perception and the Process of Reading

The perception of objects including words, involves many sources of information beyond the stimuli reaching the eyes. It is a process of interpreting and integrating the stimuli in terms of existing conditions. R. L. Gregory, director of the Perception Laboratory in the Department of Psychology at Cambridge describes the process as:

> The seeing of objects involves many sources of information beyond those meeting the eye when we look at an object. It generally involves knowledge of the object derived from previous experience and this experience is not limited to vision, but may include the other senses; touch, taste, smell, hearing and perhaps also temperature or pain. Objects are far more than patterns of stimulation. Objects have pasts and futures; when we know its past or can guess its future, an object transcends experience and becomes an embodiement of knowledge and expectation without which life of even the simplest kind is impossible.[8]

> Perception is not determined simply by the stimulus patterns, rather it is a dynamic searching for the best interpretation of the available data. The data is sensory information and also knowledge of the other characteristics of objects. . . But it seems clear that perception involves going beyond the immediately given evidence of the senses: this evidence is assessed on many grounds and generally we make the best bet, and see things more or less correctly. But the senses do not give a picture of the world directly; rather they provide evidence for checking hypotheses about what lies before us.[9]

---

[8] Gregory. 1966. (47) p. 8.

[9] Ibid. p. 11.

Edward Thorndike describes the process of perception in reading in similar terms:

> . . . understanding a paragraph is like solving a problem in mathematics. It consists in selecting the right elements of the situation and putting them together in the right relations and also with the right amount of weight or influence or force for each. The mind is assailed, as it were, by every word in the paragraph. It must select, repress, soften, emphasize, correlate, and organize, all under the influence of the right mental set or purpose or demand. [10]

Perception in reading however, should be differentiated from the perception of other visual objects because the visual task in the former requires more complex processes for its completion than the latter. Ettlinger points out:

> Subhuman animals make many kinds of visual discrimination (e.g. of intensity, color, extent, position, orientation, and form); and they learn to attach significance to the objects and events which they see. Man, in addition, learns to recognize the significance of forms (or shapes) which we call letters. He can read, and this is visual perception of form at its most complex level. For reading also involves the use of language. It is the visual discrimination of forms which we have learned to recognize as representing the constituents of auditory/oral language. The dissolution of this perceptual process can only be studied in the neurological clinic. [11]

---

[10] McKillop. 1952. (74) p. 1.

[11] Ettlinger. 1964. (28). p. 185.

Two major considerations must be kept in mind in relation to perception in reading:

1. All words are primarily speech units. Some vestige of auditory and oral processes always accompany reading because words written and read derive directly from spoken words (103).

2. Comprehension of the visual and auditory structure of a word is insufficient for its perception. Words are symbols of meaning and some awareness of the idea or experience it is meant to convey must have previously been learned by the reader.

The Perceptual Process

The perceptual process begins with the stimulation of the sense organs by some external factor. The stimulus is conveyed by the sensory nerves to the central nervous sytem. Here a process of mental elaboration occurs which results in the percept as we know it.

After the initial stage of peripheral sensory excitation, three essential aspects appear to accompany a completed perceptual process.

1. Constructional process. The central nervous system weighs and combines the sensory qualities, assigning each its appropriate degree of importance into a relatively clearly differentiated formal structure.

2. Assimilative process. The percept on hand is related to the body of past experience. The percept is compared, and accepted or rejected. Then it is referred back to the origination point in the external environment.

3. Response tendency. This indicates the perceiver's reaction to the percept. The response may be overt or implied.

Differentiation and classification of these three aspects may be specious because the exact nature of the operation is unknown. The three, however, exist simultaneously and are interrelated. Any one may appear most clearly in awareness in any instance, although all contribute to the understanding of meaning.

The perception of words or other printed symbols is always accompanied by the process of "inner reading" or "inner speech." Before full awareness of meaning takes place some type of auditory or vocal process occurs. This process may take the form of actual laryngeal movements or of auditory-kinaesthetic-verbal imagery. Vernon (103) describes an experiment which reported that the auditory image could be reproduced when only hazy parts of the word had been seen, and not a single letter actually identified. A continuous sub-vocal sounding of words accompanied by laryngeal and lip movement of the words when they have been perceived and understood is known to be associated with the normal reading of prose or poetry. The process of inner reading follows the process of perception at a

relatively constant distance. Because these processes are neither persistent or prominent, they are difficult to isolate.

Meaning and Imagery

The question whether images accompany the process by which meaning is obtained from the visually perceived form of words is disputed. Three contentions prevail:

1. Meaning can be obtained without resort to any imagery of what the word symbolizes.

2. A rudiment of imagery is precursory and an integral part of obtaining meaning from words.

3. Meaning is comprised of sensations and imagery, and components of the process of acquiring meaning may be classified into these two areas.

Whole Versus Part Seeing

Diack (26) has continued the investigations on whole versus part seeing, a question that has interested researchers many years. He reported that experiments carried out by Pillsbury in 1897 had found that subjects were unable to detect slightly mutilated words in most instances. Pillsbury noted three cues by which words are recognized:

1. The configuration of the whole word. This was determined by its length, the projections produced by high and low letters and the location of the clearly seen letters within the word.

2. The clearly seen letters themselves. These may fall within and adjacent to the area of fixation.

3. Context. Words that were related in meaning to the mutilated words were supplied and assisted in their recognition.

Diack also stated that Zeitler's conclusion that capital, high and low letters acted as major cues in word recognition in place of configuration had been rejected by Woodward because the general shape of the words was usually retained in the former's experiments.

Diack himself conducted three experiments where the variables of exposure time, and expectation of the word to be seen in relation to word recognition were tested. He published these conclusions:

1. Words are not perceived immediately. Whether the word to be exposed is previously known or not; if it is presented for a period of the order of one-hundredth of a second, it will be seen as a grey band.

2. A subject who is dependent solely upon the retinal image and his own previous knowledge of the printed word in general will as, the exposure time is gradually increased, distinguish parts of the word. That is, he does not see it in all its details either immediately or simultaneously.

3. When a subject is led to expect to see a particular word by being told which word is to be exposed, he will see that the word in its entirety in that fraction of time during which without this information he is able to distinguish only a letter or two.

4. In certain definite circumstances a subject will see a whole word in all its details even if all the details are not there. These circumstances are (a) that he should be expecting to see a particular word (b) that what is exposed should bear a close resemblance to what he is expecting to see (c) that the time of exposure should be so brief as to prevent a close examination of what has been shown. [12]

He concluded that when the visual system receives only a retinal image as input, it begins to analyze what is taking place. Perception is speeded up when appropriate supplementary information is provided. This additional information, however, may under certain circumstances be responsible for optical illusions when it contains inaccuracies.

In proofreading typewritten material, the reader usually has prior knowledge and holds the expectation that the words conform to the original material from which it was copied. Although exposure time is usually unlimited, Diack's second and third conclusions may help to explain the reason why accurate error detection has seldom been found.

The Factor of Repetition in Perception

Haber (50) studied the effects of repetition and exposure time on the perception of words. The subjects were exposed to pronounceable words containing seven letters of three syllables for a constant

---

[12] Diack. 1960. (26) p. 79.

period of time. They reported the letters they were certain they had seen after each presentation and were scored as having perceived a word if all seven letters were included.

During the initial exposures the subjects indicated that nothing had been seen. As the presentations were repeated the subjects reported first the beginnings of letters, then whole letters, and often the entire word. Haber states that:

> The percept of the word that developed with repetition was not fuzzy or unclear, nor was it the result of a guess or hunch. It assumed a clear status, so that the subject was never uncertain about his reports, even though he had not been able to see anything a few presentations earlier. Many subjects reported afterwards that they thought the duration or intensity of the stimulus was being increased between trials, and they were quite surprised to find that there had been no changes made. [13]

The same experiment was repeated with meaningless words using English and Turkish languages. The rate of increase in recognition with repetition was similar for each language and duration of exposure although perception of the letters of English words was greater than the other.

A third experiment examined meaning and reported these findings:

> Giving prior exposure immediately before the trials of a word increased the probability of seeing its letters. A difference in perceptibility between rare and frequent words was also found, but only when no prior exposure was given. Since these data were collected using a

---

[13] Haber. 1964. (50) p. 205.

> clarity rather than a guessing indicator, they suggest that as long as the differential frequency of the words was not eliminated by prior exposure that differential affected the clarity of the letters directly, not just the ability to guess the highly redundant ones. . . The most important result of this experiment however, was the similarity in rates of development of the percept as a function of any of the experimental variables. Specific prior exposure did not facilitate the rate of increase of seeing letters. It affected the amount of clarity--prior exposed words were seen more frequently--but not the rate of increase as a function of repetition. [14]

These experiments suggest that repetition or repeated exposures of a stimuli help to increase its clarity during the process of perception. Even highly familiar words are not immediately perceived unless the duration of the initial presentation permits it to be. The effects of repetition are summarized by Haber:

> In these experiments the effects of repetition are invariant over a number of quite different operations--duration, language, prior exposure and frequency--operations that normally account for large portions of variance in most word recognition experiments. In these studies they account for variance in the level of clarity--each of them increases clarity--but they do not interact with repetition. They determine the clarity of the percept on the first presentation, and the ultimate clarity after many presentations, but seem to have little effect on the rate of increase in clarity with repetition. [15]

Illusions

Illusions or distortions in visual perception have been subjected to investigations over many years. Gregory (47) classifies them into

---

[14] Ibid. p. 207.

[15] Ibid. p. 209.

two general categories. Some are distortions produced by external surrounding factors, while others are distortions themselves.

The most common illusions include distortions of size, shape, distance, and depth. These misconstructions arise from the analysis and inferences which the visual system undertakes in the processing of sensory information. Although errors occasionally occur in the operation of visual interpretation as alternative hypotheses are being tested and deductions are being formed, Gregory reminds us to bear in mind the relative efficiency of the total system.

> The continual searching for the best interpretation is good evidence for the general importance of augmenting the limitations of the senses by importing other knowledge; but the ambiguous figures show this system at a curious disadvantage because they give no clue of which bet to make, and so it never settles for a bet. The great advantage of an active system of this kind is that it can often function in the absence of reliable information--like a good officer in battle. But it sometimes makes a wrong decision.[16]

Extreme stress and other emotional problems may upset the visual system and cause illusions. The reader's past experience and learning also will determine the way visual information is interpreted. If the system is unable to operate in the absence of sensory input, much of our everyday activity would be slowed down, and in some instances, stop altogether.

---

[16]Gregory. Loc. cit. p. 223.

Reading and Proofreading as Visual Tasks

As business educators consider the reading and proofreading aspects of the curriculum it should be remembered that reading per se is a remarkable visual skill. The control exhibited by the visual system as the reader follows the lines of words on a page interpreting abstract symbols into meaningful terms is an astounding feat of discipline. Moreover, in proofreading the reader is expected to evaluate the correctness of every letter found therein and to decide whether the use of language is accurate or not. This feat has been made possible and is the result of many years of visual training during the elementary school years, although all will vary in the level of skill acquired. Over a period of time this training predisposes a student towards printed words to a point where they dominate over other subjects in the visual field (82).

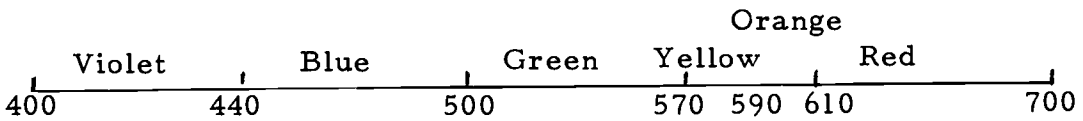
The aforementioned studies should help us to understand why the accurate proofreader is a rarity. A multitude of variables about which we have scant knowledge, can cause a reader to misperceive or misapprehend errors in the material read as being correct.

The Effect of Colour

The conditions under which we perceive colour are closely linked to those by which we see visual objects and by which we read. The Optical Society of America uses the following definition of colour:

> Color consists of the characteristics of light other than spatial and temporal inhomogeneities; light being the aspect of radiant energy of which a human being is aware through the visual sensations which arises from the stimulation of the eye. [17]

Colours result from light waves of varying wave lengths which produce an effect we call "colour" when the visual system is activated. The following diagram shows the wave lengths of the colours seen by the viewer (54).



Basic Colour Properties

Hue, value, and brightness are the three basic qualities of colour. Hue or saturation is the characteristic which applies to the groups of waves of similar length in that portion of the electromagnetic spectrum where colours can be differentiated from each other. Each group is identified by the names red, green, blue, and yellow

[17] Evans. 1964. (29) p. 1467.

with one blending into the next when viewed in a spectrum. Sir Isaac Newton, who is credited with the first theory of light and colour, named seven hues--violet, indigo, blue, green, yellow, orange, and red, but subsequent experiments have shown that there are only four spectral colours--blue, green, yellow, and red. More than a hundred different hues are found in the colour spectrum but these contain tinges of one or more of the pure spectral colours.

Value refers to the quality of lightness or darkness that is associated with a colour, e.g. light blue or dark blue. When white is added to produce a lighter blue, the resultant colour is called a tint. Shades of a colour are obtained by the admixture of black.

Brightness which is closely related to luminosity refers to the quantity of light energy that reaches the surface from which it is reflected. The wave length of the light is disregarded.

Luminosity describes the effect of the light energy on the visual system. Yellow green is the most luminous of all colours because these light rays come to a focus in the smallest possible area on the retina. The smaller the area of concentration, the brighter will be the colour. Blue colours come to a focus some distance in front of the retina affecting an area five and a quarter times as large as that of the yellow-green.

Light, Colour and the Process of Vision

When light strikes an object it is either reflected or transmitted. A very small amount will be absorbed and transformed into heat. The wave lengths that are absorbed out of white light determine what colour is seen. Most surfaces are not transparent and the phenomenon of colour arises from the interaction of light waves of varying lengths that are reflected from opaque surfaces back to our eyes. In most instances the same colours will be absorbed by a given material whether the light is transmitted or reflected, hence the object is seen as the same colour by both methods. Exceptions occur where the interior of a substance differs from the surface condition. The absorption rate is affected and the colour viewed is different. For example, gold appears yellow by reflected light, but appears green by transmitted light when viewed through a thin piece of gold film. The reverse colours are seen in certain oils. This phenomena is called diachroism.

Rods and cones in the retina contain pigment which are sensitive to light waves of varying lengths and are responsible for our ability to see colour. They are not equally sensitive, however, with rods most sensitive to the green region of the colour spectrum. Cones are most sensitive in the yellow region. The difference in sensitivity results from the variation in pigment found within the rods and cones. Rods

are relatively inactive in the dark, where the cones take over the major visual task. In the early 1960's scientists at Harvard and John Hopkins Universities finally substantiated a physiological explanation for the viewer's ability to discriminate colours. They clearly established the existence of separate red, green, and blue sensitive cones in the retina.

Perception of Colour

While it is possible to measure and control the light source and colour of objects in experimental situations, the response or operation of the visual system in the perception of colour is immeasurable. Three types of interrelated variables affect the perception of colour: physical, psychophysical, and psychological.

1. Physical variables refer to the measurable and controllable factors. These include the wave length of the colour stimulus and the amount of radiant energy at each wave length.

2. Psychophysical variables may be manipulated to determine whether a viewer will match two given color stimuli under controlled conditions. Psychophysical variables are usually considered in terms of dominant wave length, colorimetric purity and luminance. Dominant wave length refers to that wave length of light which when mixed with a certain amount of coloration-free light, matches the stimulus. Colorimetric purity is the quality of lightness and darkness

which can be stated as that fraction of the monochromatic light in terms of the whole. Luminance is the intensity of the colour stimulus in relation to the sensitivity of the eye.

3. Psychological variables include the factors required to describe the colours that an observer sees.

Ralph Evans (29), Director of the Photographic Technology Division of the Eastman Kodak Company suggests that the psychological variables traditionally used (these have been stated in the same terms as the psychophysical variables) may be insufficient. He advocates that the psychological perception of colour be viewed in two ways:

1. Light-colour perception. Colour perception may be analyzed from the viewpoint of the visual effects that result from the interaction of light with our eyes. The illumination in this case may be assumed to be constant and transmitted without change.

2. Object-colour perception. When light is reflected from a surface, it is modified and appears to have qualities that differ from the ray emitted from the source of illumination. More than one object must be present to permit the perception of the illumination as distinguished from the object. In light-colour perception the object viewed is not always seen as having the same colour.

In considering the psychological aspects of colour perception outside of the laboratory, a coloured area is surrounded by other

colours in a normal environment. Evans states that psychophysical variables must be expanded to include the colours of the surroundings thereby doubling the number of independent variables. He concludes:

> If perceived color is defined in such a way that no perceived object properties are included, a considerable simplification is introduced into the subject. At the same time it becomes possible to state a meaning definition of perceived object color.
>
> It follows, however, that perceived color has at least four independent dimensions and that there may be other perceptual color dimensions which may or may not be independent.
>
> It is possible to divide all perceived colors into two classes, here called modes of perception, depending on whether the perception is that of the color of the light reaching the eye (the light mode of perception) or of the effect of an object on the perceived illumination. It is not useful to distinguish between reflecting and transmitting objects. Such distinction would deal primarily with the difficulty of discounting the brightness factor in the reflection case when perceiving in the object mode under some circumstances.
>
> Furthermore it is found that, as far as existing knowledge allows, all perceptions such as lightness, contrast with the background, and color contrast are dependent on the basic variables; hue, saturation, brightness, and gray content; the relationship depends entirely on the difference between the psychophysical parameters of the primary stimulus and those of its surround.[18]

Emotional Effect of Colour

Colour has an emotional effect on the viewer because certain hues are associated with past experiences (4, 5, 41, 87). The

---

[18] Ibid. p. 1473.

influence of tradition and culture are apparent with different colours being connected with emotions such as joy and sorrow in different societies. For example, white is the colour of mourning in China while red signifies happiness. Black is a neutral colour but in western Christian society it bears the connotation of sorrow or mourning.

Faber Birren believes that the critical psychological factor in colour perception is internal.

> Beauty or ugliness is not out there in man's environment, but here within man's brain. . . The perception of color--including feeling and emotion--is the property of human consciousness. . . Color is individual to human experience and sensation. [19]

Professors Bills and Harris on the other hand, warn against overemphasizing the influence of colour.

> Color alone is seldom the exclusive variable in determining the emotional behavior that exists in any given situation. However it undoubtedly does have considerable influence, especially in situations where other factors are not too dominant. One important variable is the personality or organization of the individual viewer. [20]

Colour and Written Communication

Gaw and others (41, 63, 88) have strongly recommended the use of colour as a direct aid in reading and understanding. The

---

[19] Birren. 1969. (5) p. 66.

[20] Bills and Harris. 1953. (3) p. 158.

graphic arts now supplement print in many phases of written communication. Colour is now integrated into basal reading programmes, textbooks, and workbooks in all subject areas including typewriting. The use of colour without some purpose or objective, however, may be a waste of funds and produces negative effects. Ketchum and others (65, 99, 63, 2) report that little significant influence has been found in their research.

Background Colour

The background colour in printed materials through the use of papers of different hues is another aspect of the problem of reading in relation to readability. Gaw (41) recommends that paper of light, delicate tints be used. Although the reader is not aware of the colour of the page when it is used in isolation, it exerts a psychological power more often on the subconscious rather than conscious mind (41). Papers coloured with light tints are hardly differentiated when compared to fully saturated ones. When placed against paper of its complementary colour, the tint takes on glow and produces a stimulating effect. Light coloured tints are recommended because they contribute to the legibility of the printed words. Eyestrain and fatigue can be caused by brilliant colours and dark colours do not supply enough contrast. Light colours do not detract from the printed words.

Some basic colour principles have been enumerated by Gaw: (41)

1. Contrast may be obtained by adding black to a coloured ink or by the use of complementary colours in the ink and paper.

2. Coloured inks are legible in this order: blue, purple, red, and green. Yellow and orange ink are illegible. Any of the first four colours may be used in pure hue on white paper if the quantity of material is small and if the type face is large.

3. The same colour ink deepened with black or one that is related in hue should be used for lengthy copy for maximum legibility. The darker the colour of the paper, the darker should be the shade of ink that is to be used.

4. Complementary coloured ink is effective for short copy. It may also be used for underlining key words. Colours are intensified when complementary hues are placed against each other.

5. Maximum emotional appeal may be obtained by using two colours of ink on a coloured page.

6. Typographical factors that affect readability include style of type face, type size, type boldness, leading, and length of line.

J. H. Rothchild (71) investigated the attention value of coloured envelopes and papers by sending the same message on different combinations of hues to 12,000 customers of the firm for which he worked. The effect of colour was scored in terms of customer response. The data collected suggest that contrasting colours result in higher

customer response. Customers appear to favor gold and pink over white, corn, and green.

Research in colour is limited and the state of knowledge aptly summarized by Bills and Harris in 1953 is still valid,

> After a review of the literature that pertains to color, the most valid conclusion which might be offered is that this field of investigation is in its infancy. Well-tested and scientifically precise generalizations must await the development of a theory of colour influence. Until a theory is developed research will be random and generalizations will exist as isolated items of information.[21]

Methods of Proofreading in Typewriting

Proofreading procedures may be classified into three general categories.

1. Independent, autonomous, individualized or solitary proofreading. The reader checks copy alone and takes full responsibility for the accuracy of the work.

2. Cooperative or team proofreading. Two persons work together and take joint responsibility for accuracy.

3. Proofreading Machines.

Independent Proofreading Methods

1. Paper Bail Method. This is highly recommended for typewritten materials. After the typing has been completed, the typist

---

[21] Ibid. p. 160.

proofreads before the paper is removed from the machine. The sheet is rolled back to the first line and the reader follows the words with a pencil held along the paper bail. After a line has been checked the cylinder is turned up one notch to the next line and this procedure is repeated until all lines have been read. Any errors found are much easier to correct if the paper is left in the machine because the problem of aligning the new strokes to the old is avoided.

Even if the sheet has been removed, this method of line-by-line proofreading may be used. A ruler or piece of cardboard substitutes for the paper bail. If errors are found, however, the typist must put the paper back into the typewriter and align the strokes so that the corrections will not be noticeable.

When the reader works alone in finding errors, he must reorient himself from his normal reading pattern. In place of speedy comprehension of the material read as a whole, which is the objective of general reading development programmes, the proofreader must revert to the deciphering of words on a letter-by-letter basis. Each word or phrase must be compared to the original data. In addition to looking for spelling, punctuation, and grammatical errors, the reader must check for accuracy of thought content. Then in typewriting the margins, spacing, and other mechanics of organization must be reviewed. Thus at least two readings are deemed necessary.

2. Exchange proofreading. A variation of the independent method is to ask another person to check one's own work. The rationale for the use of this procedure is the belief that one is more careful in checking work that is new. At the same time one can decrease the psychological problem of loss of objectivity encountered when one looks and finds errors in one's own work.

Cooperative or Team Proofreading

In this method one person, the copyholder, reads aloud from the original copy or manuscript while the other, the proofreader, checks the work under review. The team method of proofreading usually is more accurate but more costly than the single reader method. Another disadvantage is that the proofreader often must look at the copy being verified himself, and consequently loses the subtle advantage of continuously visualizing the original manuscript.

Proofreading Machines

1. Optical Scanners. Among the innovations marketed by the electronics industry are the prototypes of the optical scanners. These can mark and score assignments and tests. One of these models call called the Electronic Character Reader has been programmed for use in typewriting. The machine can perform the following functions:

> [It can] . . . compare each character of the student's paper with a master copy, and at the same time, on a perforated sheet, type the student's name, the line number, the student's error, and the correction. This includes typographical errors, words omitted, and words added. It can sort the perfect papers into a separate stack. The present machine does not correct spacing, such as paragraph indentations, spacing after a period or between commas.[22]

These machines hold great promise for classroom checking of typing work if the cost can be reduced to a reasonable level. In spite of the availability of such mechanical devices, however, the proofreading problem remains. Someone must still prepare the master copy for the machine's programme and this must be proofread perfectly or calamitous results will follow. Moreover, a lapse of time will occur before the student's work can be returned, engendering forgetfulness on his part of the conditions under which he produced the work, as it is probable that such a machine would be available on a regional rather than individual school basis at the onset of its use.

2. Tape Recorders. With the expanding availability of inexpensive tape recorders in offices and classrooms, a proofreading method devised by the University of Toronto Press may be found useful. The proofreader reads the original copy into the tape recorder including clarifying comments and instructions for organization as needed.

---

[22]Robinson. 1966. (91) p. 130.

Then he listens to the playback as he proofs the copy. The total man-hours required appear to be significantly less than the traditional procedures of using either a single reader or a proofreading team. Moreover, this method obviates one of the major disadvantages of the latter method--the inaccuracy of communication between copy-holder and proofreader since both are the same person. With the reusable feature of tapes, the potential cost savings to be realized in this method appear substantial.

3. Overhead Projectors and Opaque Projectors. These machines have been used to magnify the work under correction in classroom situations. Magnification aids the reader in finding mistakes and also provides the advantage of group reading and discussion of errors. A teacher can focus the students' attention onto specific errors to be emphasized. A student may also work alone since these machines are relatively easy to operate.

The accompanying disadvantages of using these machines, however, restrict the application of their use in proofreading typewritten copy produced in the routine of daily work. A transparency must be made for the overhead projector with the cost of preparation time and material to be considered. The opaque projector must be used in a darkened room which limits the proofreader's ability to make notes about corrections. In addition, the work must be removed from the

typewriter and the problem of aligning new strokes to the old is encountered.

Recommended Methods and Techniques

A number of educators have written about methods which they have found effective in the instruction of proofreading skills. Most of them teach in the subject areas of Business Education and English. The methods are briefly summarized:

Students should be taught that the pattern of reading in error detection differs from normal reading. Too often they are simply told to "check their work and find all errors." The procedure of reading letter-by-letter, with word-for-word comparison and the search for other grammatical errors must be demonstrated. Thought content and organization of material may necessitate additional readings.

Short "chalk talk" sessions help students to diagnose the causes of common errors made during the period. These discussions should be interspersed so that they provide brief rest periods after typing practice.

Students should proofread their work from the onset of instruction. A chart may be kept where they record their progress in error detection in the same manner that they record their speed and accuracy rates.

Knowledge of office standards and what constitutes acceptable work should be presented as early as possible. The procedure for indicating errors, such as circling, should be consistently followed.

Adequate time must be provided for thorough proofreading. The instructor should keep in mind the wide range of reading rates that will be found within each class and not rush the students.

The rules of English usage and the mechanics of correct organization must be taught and reviewed constantly.

A teacher may ask a student with a severe proofreading difficulty to read his work aloud on a one-to-one basis over a period of time.

Proofreading games and tests consist of error loaded material which may be duplicated and distributed to the students. They attempt to find as many errors as possible on an individual, team, or class basis.

Peterson and Staples (84) have recommended that short writing lines be used in introductory proofreading exercises. They claim that the short length of line is likely to encourage the development of more frequent eye fixations which results in better error detection.

The proofreading problem can be given wide publicity in the classroom. A teacher can display exhibits of typographical errors from material collected from the daily newspaper, the school's newspaper, magazines, and other print sources.

Standard reference works such as a dictionary, and books on English usage should be readily available to the students.

Staples reports that the physical facilities and layout of the typewriting classroom are important factors (100). Elements such as lighting, room temperature, and local classroom disturbances are variables that affect the development of proofreading skill.

Errors can be reduced and time and effort saved in typewriting if students avoid end-of-line-word divisions (13).

Reward proficiency in proofreading. A separate grade may be assigned to proofreading which in turn may be integrated into the final composite mark for typewriting.

Penalize students for undetected errors. Students' papers which contain uncorrected or unmarked errors may be returned to them. No credit is given for the assignment until corrections have been made.

Brendel (14) recommends a number of techniques to be followed in team proofreading. The copyholder should:

1. Read at an even pace to give the proofreader time to check the copy carefully.
2. Stop reading when the proofreader indicates a correction is in order.
3. Spell out unusual proper names and terms.
4. Read out all punctuation marks.
5. Read figures carefully and clearly.
6. Indicate paragraphs, capitals, quotation marks, parentheses, and symbols (percent, ampersand, number, etc).

7. Enunciate s's clearly.
8. Indicate possessives and hyphenation.[23]

The proofreader should:

1. Use a colored plastic ruler or cardboard; moving it down line for line as he checks the work.
2. Read slowly--word for word--for sense, as well as for accuracy.
3. Indicate errors in margins nearest the errors.
4. Question anything not clear.
5. Make no changes without the approval of the copyholder.[24]

In summary, low levels of proofreading efficiency are commonplace in typewriting, but an extensive search of library resources is needed to obtain information about effective methods. A number of techniques are advocated but no procedure has been clearly established as being superior to the others. The most serious problem appears to be the omission or superficial coverage of proofreading instruction in the published materials usually designated as basic texts. For example, no mention is made of the subject at the time students are taught to calculate their typing rates in the two texts prescribed for Typing 9. The subject is not even listed in the index of each book. Business teachers are probably aware that students do not proofread well, but the diagnostic and remedial tools needed to attack the problem are not made available.

---

[23] Brendel. 1954. (14) p. 296.

[24] Ibid. p. 296.

Modification of Proofreading Ability

Whether readers are capable of proofreading with 100 percent accuracy is a continuing controversy. On one extreme is found the belief that proofreading ability is innate and unchangeable. Crosland states:

> We believe that the reader's keen abilities to discover errors, his acute capacities of perceptual discrimination underlying his high degree of accuracy are innate or at least were attained long before he undertook practice in the reading of proof and that they predetermine that his absolute error scores will be more constant than those of the very inaccurate reader who likewise we believe, inherited his abilities or attained them in relatively unmodifiable form long before practice was had.[25]

Although the source of reference was not published, Foster (37) describes research conducted with typographers where a proofreading team would miss one error per 1000 words of copy reading at a rate of 40 words a minute, and some had double this rate of inaccuracy. His interpretation of the data is that proofreading ability is basically unmodifiable to an extent where a poor reader can be trained to become an excellent one.

On the other side experts have written about techniques which they have found successful. Staples, Brendel, Clem, Hanna, Gregg, Green, Cleary and Lloyd are representative of business teachers who

---

[25] Crosland. 1924 (24) p. 131.

believe that proofreading skill development is possible. English teachers such as Johnson and McKowen have advocated the same. Furthermore, the studies which related to some aspect of proofreading in language arts, carried out by Nichols, Frasch, Goss, and Personke and Knight showed that an improvement in proficiency could be attained. Although Bond and Tinker were writing about reading, their comment appears applicable to the proofreading problem.

> There is every reason to adopt a favorable view concerning what can be done with reading disability cases by the application of appropriate remedial procedures. Like any skill, reading will show improvement with practice. With good motivation and sufficiently individualized instruction based upon careful diagnosis, progress will result. Obviously the improvement with remedial training will be more rapid in some cases than in others. Nevertheless if the pattern of difficulties has been discovered by accurate diagnosis, one rarely has a case that does not respond satisfactorily.[26]

In view of the foregoing, one's position must revert to personal bias and empirical experience. Although errors can be found in any situation at any time, the observation that all occupations treat accuracy rather than inaccuracy in our daily work as the normal expectation shows that not as many proofreading errors remain undetected as one might anticipate. The data from proofreading research (24, 30, 37, 100) which indicate that an extremely small number of people

---

[26] Bond and Tinker. Op. cit. p. 12.

are able to detect all errors might lead to the generalization that most people will not find all errors. But practical experience in any field of work makes us realize that this level of inaccuracy does not exist, that we do not consistently find errors in output that remain undiscovered. Inaccuracies acceptable when made by children and even relatively mature students are quite unforgivable if these are overlooked by the adult professional. Thus the question of the Hawthorn effect arises about the findings of these studies concurrently with the realization that the amount of research data available is limited. The literature does, however, indicate that most people are unaware of the difficulty and complexity of the proofreading process, hence the traditional expectation that all errors will be easily found and corrected is suspect.

Types of Errors

An accepted system of classification and nomenclature for the identification of proofreading errors has not been established. In the limited number of investigations that have been conducted, each researcher has found it necessary to select and define errors on the basis of the nature of the research and/or arbitrarily on personal bias. This is not illogical when one considers the potential number of errors that can be made if each is designated separately. Furthermore some types of errors overlap. Transpositions also may be

classified as misspellings and mistakes in indentation may be treated as spacing errors.

Crosland (24) undertook one of the first studies conducted on proofreading. Five groups of subjects which included five professors of Journalism, five typographers, four professors of Psychology, one of Philosophy and Literature, six journalism students, and nine psychology students read 20 tests. The tests were separated into four series, each containing five papers. The study compared the proofreading efficiency of the subjects using the independent variables of stated objectives of reading, time, repetition, the location of errors and familiarity of content.

Fourteen errors were used and these are shown in the rank order of difficulty (the errors most frequently undetected by the subjects):

1. Superfluous line space
2. Omitted word
3. Omitted period
4. Omitted or superfluous quotation marks and apostrophes
5. Omitted letter
6. Superfluous letter
7. Transposed letter
8. Other misspellings
9. Wrong kind or face of type
10. Superfluous spaces between letters
11. Omitted paragraph spaces or indentations
12. Omitted spaces
13. Omitted capital
14. Superfluous capital[27]

---

[27] Crosland. Op. cit. p. 69.

None of the subjects was able to find all errors and the range of inaccuracy extended from 3.7% to 100%. Changing the objective of the reading did not produce any change in the ranking of accuracy. Professors of Journalism were found to be the most accurate readers followed by the typographers, Social Science faculty, journalism students, and psychology students.

The subjects were classified as "practiced" or "unpracticed" on the basis of past experience with proofreading. The range of experience extended from the reading of 25 galley proofs to more than 10 years of employment in the printing trade. Both practiced and unpracticed readers were relatively consistent in the number of errors committed from one series of tests to the others, both following the order of difficulty shown on the previous page.

Re-reading of tests was generally unprofitable. The unpracticed group experienced a slight advantage while the practiced group showed no improvement.

No effect could be attributed to the influence of learning through practice as subjects underwent the series of tests.

Although numerous references are made to Crosland's findings and conclusions in this present study, some questions arise when his data is examined. No mention is made in his report about the selection of his subjects (whether they were chosen at random) and the fact that none of the subjects completed all 20 criterion tests.

Foster (37) published a list of proofreading errors that was compiled from the results of a contest sponsored by a printing firm as part of a training programme. The test consisted of a 93-word paragraph loaded with 32 errors and contestants were limited to 45 minutes of reading time. Although all employees worked under an incentive system where a bonus was paid on the basis of speed and accuracy only three completed the test with 100% accuracy. The errors are listed with the frequency rate of inaccuracy.

1.	Letter omitted	14.5%
2.	Substitutions	14.1
3.	Space omitted	10.7
4.	Punctuation mark omitted	10.5
5.	Transpositions	6.6
6.	Words omitted	5.9
7.	Small letter for capital	2.9
8.	Full line omitted	1.76
9.	Spelling error	1.6
10.	Capital letter for small	1.1[28]

The lists developed by Crosland and Foster were reviewed by Ewart in her selection of errors to be included in her survey of straight copy proofreading errors in typewriting. Participants included junior and senior high school students, business educators, professional secretaries, and miscellaneous adults. The variables investigated were types of errors and their frequency of occurrence, and the effects of the location of errors by an analysis of the vertical

---

[28]Foster. 1950. (37) p. 383.

and horizontal halves of a page. The ten errors chosen were those which Ewart believed were most representative of actual errors made in typewriting with an objective of minimizing the spelling factor (which appears virtually inseparable) to the greatest extent possible. These errors are shown with the number of errors per subject.

1.	Doubling error - of small words or syllables within a word	1.9
2.	Spacing error - omitted and superfluous spaces	1.8
3.	Omission of letter	1.6
4.	Transposition of letters	1.6
5.	Substitution of small words	1.5
6.	Omission of one of a pair of doubled letters	1.4
7.	Transpositions of words	1.3
8.	Punctuation - omitted and incorrect punctuation	.9
9.	Omitted word	.9
10.	Line skip error - complete line omitted	.04[29]

An examination of the subgroups' scores shows that the order of difficulty varies although the first seven errors headed the list for all subjects. Out of the 2,538 participants only one was able to find all errors. The scores of the three student groups and the miscellaneous adult group were remarkably similar, recording a total average error range that extended from 12.0 to 15.9. The scores of the business teachers and professional secretaries also reveal this contiguity with averages of 8.9 and 9.8 respectively. The relative reading efficiency of the subgroups is shown:

---

[29] Ewart. 1963. (30) p. 31.

Group	Average Total Errors Per Subject
Junior High School	15.9
High School	13.3
College	12.0
Miscellaneous Adults	13.2
Professional Secretaries	9.8
Business Teachers	8.9[30]

A composite list of errors was compiled from the three aforementioned studies in order to compare the types of errors used and the rank order of inaccuracy. It was found necessary to reclassify specific error names into more generalized categories, e.g., omitted period is included in punctuation errors so that any pattern that existed would be easier to discern. These categories are arranged in alphabetical order:

1. Capitalization - omitted or superfluous
2. Doubling of small words or syllables within a word
3. Letters - omitted or superfluous
4. Misspellings
5. Punctuation - omitted or superfluous
6. Spacing - incorrect, omitted or superfluous spacing between letters, words, lines, or paragraphs
7. Substitutions
8. Transpositions - of letters and words

---

[30] Ibid. p. 36.

9. Type face - wrong kind or face of type

10. Words - omitted

The rank order of inaccuracy is shown below so that the types of errors reported may be compared. In spite of the fact that no pattern of difficulty is discernible, the rank order of accuracy was found to be an invalid basis for comparison not only because categories were not uniformly included, but also because the data were obtained from different although in some cases, overlapping populations. Hence it is difficult to state which error types are likely to provide the greatest difficulty in proofreading, although categories 6, 3, and 8 are found in the upper half of the ratings. The selection of error types to be included in a study will likely continue to be chosen selectively until further data are available.

Rank	Crosland	Foster	Ewart
1	6	3	2
2	10	7	6
3	5	6	3
4	5	5	8
5	3	8	7
6	3	10	3
7	8	1	8
8	4	6	5
9	9	4	10

Rank	Crosland	Foster	Ewart
10	6	1	6
11	6		
12	6		
13	1		
14	1		
Categories Omitted			
	2	2	1
	7	9	4
			9

Staples attempted to ascertain the composite elements of proofreading ability in typewriting and to discover the factors that accounted for differences in proofreading skill by correlating proofreading efficiency to selected factors of achievement, interest, and aptitude. Efficiency was measured through the scores obtained from tests constructed by the researcher and their subsequent comparison to scores obtained from selected standardized tests. The subjects consisted of 100 freshman and sophomore college students enrolled in Staples' classes and 40 professional secretaries currently employed. The method used in the selection of subjects was not reported.

The criterion tests consisted of a manuscript, a table, and two letters. The errors chosen for inclusion were obtained by asking the students to type the material and errors made were then

integrated into one test. The manuscript was loaded with 235 typescript errors. Staples' list showed 26 error types. The rank order of difficulty was not reported.

1. Omitted letter(s)
2. Transposed letters
3. Superfluous letters
4. Other misspellings
5. Omitted spaces between words
6. Superfluous spaces between words
7. Omitted spaces between lines
8. Superfluous spaces between lines
9. Omitted paragraph spaces or indentations
10. Uneven paragraph indentations
11. Omitted capitals
12. Superfluous capitals
13. Floating capitals
14. Omitted marks of punctuation
15. Superfluous marks of punctuation
16. Omitted words
17. Superfluous words
18. Omitted numbers
19. Superfluous numbers
20. Transposed numbers
21. Improper alignment of figures in columns
22. Interchanged symbols with words or vice versa
23. Incorrect use of underscore and/or interchanged with hyphen
24. Incorrect alignment of words in columns or heading
25. Incorrect division of words at ends of lines
26. Strikeovers [31]

Staples reported that none of the subjects was able to detect all errors. The standardized tests used in the study included the Minnesota Clerical Test; Otis Quick Scoring Mental Ability Tests, Gamma; Spelling Test for Clerical Workers; Scholastic Aptitude Test (administered to students only); Edwards Personal Preference Schedule; and

[31] Staples. 1965. (100) Appendix

the Kuder Preference Record - Vocational. Only two factors out of 15 measured by the Edwards test--Deference and Endurance--were found to be significant for the secretarial group. Affiliation was the only factor significant for students. The spelling scores were significant for students. The verbal and mathematics section of the SAT, the names and numbers section of the Minnesota, and the Otis scores were reported to be indicative. It appears that none of the standardized tests can be used alone for prognostic purposes in proofreading. The factors of age, education, and work experience were found to be insignificant.

Staples expanded his list of errors in an article co-authored with Peterson (84). These errors pertain particularly to typewriting problems including locational factors. They are:

1. Errors in headings and subheadings
2. At the beginning or end of lines
3. Bottom of page
4. Long words - in word recognition we look for last and first letters
5. Captions or footnotes
6. Proper nouns - because of the multiplicity of ways people spell names
7. Vertical enumeration
8. Number classification

Error Load in Copy - (Frequency of Encounter)

A paradox facing every investigator in the construction of a test in proofreading is the number or frequency of errors that should

be included. If a relatively large number is used, the proofreader faces the problem of what typographers call a "dirty sheet," where the multiplicity of errors causes so much confusion that the context of the material is lost. On the other hand if only a relatively small number is used, it becomes difficult to determine whether the subjects lacked knowledge of the error or simply overlooked the mistake because of insufficient contact. The optimal number of errors to be used in proofreading studies so that a Hawthorne effect can be avoided is a variable that requires further investigation. The number of errors selected in past studies was chosen on the bias of each researcher.

Crosland's 20 narrative selections contained a varying number of errors. Fifteen tests of the first three series contained up to approximately 100 errors per sheet, while the five tests in the last series carried a range of 42 to 186 errors. Experienced typographers and journalists questioned Crosland about the numerousness of mistakes which they concluded would result in subjects reading the tests letter-by-letter since context was so befuddled. Data obtained thereby would not be representative since the reading method would be unusual because the closer examination would cause the readers to find more than the usual number of errors. Another possibility was that the readers would become so confused that fatigue would affect the performance of the subjects. Crosland admitted the validity of these

charges but since the study had already begun, there was no alternative but to continue.

The influence of error load as interpreted by Crosland is that the smaller the number of errors provided, the greater the inaccuracy rate of the reader. His data indicated that

> . . . the fewer the errors on a sheet, the more likely will the reader's errors reduce in absolute number, but not in the same ratio; also the reduction is not sufficient to prevent the reader's percentage score of inaccuracy from rising greatly.[32]

Staples loaded 235 errors into five pages on the manuscript portion of his criterion tests. All errors made by his students on the first typing of the copy were integrated into the test. He justifies the inclusion of this surfeit of errors by stating:

> Similar typewritten documents can be prepared and 'loaded' with errors selected at random. To the researcher this seemed to be an artificial method. The question is created of whether or not any or all of the deviations were actually types of errors that a typist might actually make. The procedure described in previous paragraphs is loading copy with errors that were actually made by typists performing their assignments. In this manner the errors are real, not the creation of someone's ideas or imagination.
>
> Naturally copy prepared by this method has far more than the usual number of typescript errors. However since one of the objectives of this research was to separate people into groups based on their ability to proofread typewritten copy, normal copy would have been of limited value. It would not have presented a challenge of sufficient calibre to highly competent persons to enable a clear distinction

---

[32] Crosland. Op. cit. p. 46.

> to be made of their ability. A more discriminating document with diversified problems was required for a comprehensive analysis of the issue.[33]

The rationales offered by Crosland and Staples do not obviate the problem of misinterpretation of content in the material read and its effect upon reading efficiency. Moreover, Staples states in another section of his report that the levels of inaccuracy found were higher than he anticipated. Comprehension and context are major variables in the reading process and its implications should not be obfuscated for the purpose of collecting sufficient data for investigative interpretation. Mouly (78) has emphasized that a basic tenet of educational research is that investigative methods should be adapted to the actual conditions to the greatest extent possible as they exist, regardless of their complexity, and variables should not be manipulated artificially to conform to a preconceived research design.

The Nellermoe study (79) investigated the average number of errors committed by beginning students typing straight-copy tests. The findings assist in determining the number of errors that a beginning student is likely to encounter in the proofreading of his own work. Nellermoe reported that the subjects averaged 13 errors on two tests at the tenth week and 12 errors at the seventeenth week. Each test contained approximately 100 words, so it appears that a rough estimate of 6 to 6.5 errors per 100 words of copy may be made.

---

[33]Staples. Op. cit. p. 47.

It would seem unlikely that typists would be required to proofread at the inaccuracy levels used by Crosland and Staples.

No specific reference to error load and its effect on reading efficiency is made in the Ewart survey. It would appear that the researcher selected what was considered to be the appropriate error types to be included. Subsequently a decision was made to incorporate four errors of each type (with the exception of the line skip error) into each quarter section of the page to obtain data about locational influence. This test contained 38 inaccuracies and a total of 369 words.

In a study to determine the influence of interest on proofreading efficiency, Kitross (66) inserted 60 errors into two pages of single-spaced typewritten material. He found it necessary to repeat his experiment because his first test contained an excessive number of errors. The data first collected was found to be unusable because the redundancy caused readers to concentrate on the errors rather than on the content of the passages. The error load used in the first test was not reported.

Location of Errors

The consideration of position or location of errors relative to a line of print and its influence on proofreading efficiency is another

variable about which little is known. A few studies have examined this problem, but the findings reported are conflicting.

Crosland divided his tests into vertical and horizontal quartiles and analyzed his scores. He found that half of his readers erred most frequently in the fourth vertical quartile (on the right side of the page. Although the data are inconclusive, the bottom horizontal quartile presented the greatest difficulty.

Ewart's test was divided into horizontal and vertical halves. A greater number of errors was made on the left vertical half and on thebottom horizontal half. These findings oppose that of Crosland in respect to vertical location and confirm that pertaining to horizontal location.

The following studies were undertaken to determine the location and frequency of typewriting errors. Thus the connection to proofreading is indirect, but relevant to the present study because the need for proofreading will arise at positions where errors are made. Nellermoe's study investigated the influence of location by dividing the page vertically into five parts, each quintile containing 12 typing strokes. The horizontal division was designated on a line-by-line analysis of the eight lines of copy used on the test. The researcher reported that subjects made the most errors in the second vertical area (numbering from the left side of the page) and the seventh line on the tests administered during the tenth week. During the

seventeenth week the most errors were committed in the fourth quintile for test 1 and in the second quintile for test 2. Line 7 showed the greatest inaccuracy for test 1 and line 5 for test 2. No clear distinction can be made, however, on either a vertical or horizontal basis on the factor of location.

In a study carried out in France on the frequency, nature, and location of substituted or omitted letters in typewriting, Genest (42) concluded that the factor of familiarity is a significant variable. Errors are committed much more often if they are seldom met and used. Errors were reported to occur more often at the end of lines.

Foster (37) also asserts that errors are more likely to be undiscovered in proofreading if they are found in the last half of a line, especially if the line is longer than four inches in length.

Time Factor

The duration of the time required is another variable of proofreading where data is limited. The proofreading rate may be calculated by dividing the number of words read by the number of minutes used in reading. Proofreading rates will be affected by the number of person(s) reading, that is, whether copy is read singly or by a team. The use of mechanical aids will also cause time variances. The nature and the difficulty level of the material read are other influential factors. External environmental conditions and reader

fatigue should also be considered and finally, but not least, the reading ability of the proofreader himself.

The only specific reference made to proofreading rate is found in an article by Foster (37). Although he wrote about professional readers in the printing trade, the rate may serve as a guideline. In a team situation, one error would be overlooked per 1000 words, reading at a rate of 40 words a minute, but no relationship has been established between proofreading rate and efficiency. References for the data cited were not reported.

Other proofreading studies have not reported on the time factor in terms of reading rates. Instead the duration of time used as an influence on reading efficiency has been the major consideration.

Crosland first pointed out the wide range of variability in reading time in qualified terms:

> . . . some, not all, of the most accurate readers are also the slowest readers, and some, not all, of the speediest readers are also the least accurate; that the time scores, and the ranks based on them are more variable than the accuracy scores and their corresponding ranks. . .[34]

The correlation established between reading time and accuracy rates was -.47, probable error ±.048, too small a figure to be considered significant statistically. No relationship could be established between aim in reading and time.

---

[34]Crosland. Op. cit. p. 30.

Staples, however, declared that "Proofreading rate is the best single predictive factor for determining proofreading efficiency."[35] The two groups of subjects composed of secretaries and college students were divided into top and low subgroups on the basis of their rank on their accuracy scores. Those whose scores lay in the upper 50 percent were classified as "expert or top" and those in the lower 50 percent as "average or low." Proofreading rate was reported as a significant predictive factor for both secretarial groups and for the top student group. The level of accuracy at which the subjects read was not reported unfortunately, for it would have been useful to learn the accuracy rate on the manuscript test where the subjects were limited to five minutes of reading time to detect 235 errors scattered throughout five typewritten pages.

The participants in Ewart's survey were asked to record their reading time for informational purposes, but were not limited as to time duration for the completion of the test. Ewart mentions that the factor of timing per se exerted a subtle influence because several of the business teachers stated that they had read hurriedly and consequently their reading efficiency may have been adversely affected. This statement which may be interpreted as an explanation for a low test score brings to mind another question. Is it possible that some of these subjects who had taken for granted their proofreading ability were now being tested for the first time and the accuracy level

attained did not match their expectations? As professional people most teachers assume that they can correct their students' work accurately (7, 35). While the accuracy level for their group is the best of all groups tested, the difference is not as great as one might expect.

The range of time reported in this survey is shown for the two groups for which data is available.

Group	Time/Minutes	Average No. of Errors
High school	Under 3 to over 13	17- 8.3
College	Under 3 to 9-3/4	13-12 [36]

Motivation and Interest in Proofreading

Only two studies in Business Education make reference to the factors of motivation and interest, and the data reported are inconclusive.

Staples used the Edwards Personal Preference Test and the Kuder Preference Record - Vocational to determine whether any correlation could be established between interest and proofreading efficiency. Out of the 15 personality variables used in the Edwards test, only three were found to be useful. Deference (defined as consideration of others) and Endurance (perseverance) were applicable to the

---

[36] Ewart. Op. cit. p. 43.

secretarial group, while Affiliation (loyalty) was applicable to the student group. In the Kuder test no correlation was established for students and only Social Service was relevant to the secretarial group.

Rea's study (89) which purportedly compared two methods of pointing out proofreading errors and its effect on proofreading achievement actually investigated the influence of motivation more than any other factor since no skill development factor was used. The control group followed the customary classroom practice where inaccuracies missed by the students were circled in red by the teacher who returned the papers without comment during the next class period. The experimental group had their errors pointed out to them immediately by the teacher at their desks. Essentially the difference between the two procedures is the increase in awareness by the students of the importance of finding all mistakes. Data were collected through the administration of ten tests of straight-copy typing material. Although the total errors undetected by both groups were comparable for test 1, the inaccuracy level of the experimental group dropped by approximately 72 percent during tests 2, and 3, and remained relatively constant for the subsequent tests. The errors missed by the control group also decreased, but the rate of diminution was much smaller and slower. A 50 percent reduction was recorded by test 6, but then the number of undetected errors began to rise. The data showing the control group's error percentage score

in relation to that of the experimental group disclose a decrease for tests 2, 3, and 4, followed by an increase in tests 5 and 6. A decrease is recorded in tests 7, 8, and 9, but an increase in test 10. This inconsistent pattern raises questions about the possibility of a Hawthorne effect in operation and the conclusion that personal contact between teacher and student could improve proofreading efficiency.

Two studies in the language arts area are apropos to this review of interest and motivation.

Kitross (66) tested the hypothesis that the greater the subject's interest in the content of the material read, the lower the proofreading efficiency. The subjects were asked to proofread four passages for 25 minutes. Each test consisted of two pages of single-spaced typewritten copy. At the end of the test, the passages were ranked on a scale rated from interesting to dull. The hypothesis was rejected because the tabulation of errors by percentage rank revealed results to be completely haphazard. The ranking of the level of interest for each passage, however, agreed with the researcher's expectation.

Developmental research was conducted by Personke and Knight (83) to improve proofreading in spelling. The investigators stated that motivation was critical to proofreading, but without systematic instruction, desire was insufficient. Since a dearth of instructional materials exists (only one spelling workbook out of 13 examined

contained lessons on proofreading), the researchers developed their own programme with these three stated objectives:

1. The student must attain a degree of motivation or attitude towards spelling which has been labelled "spelling consciousness".

2. The student must attain certain techniques of proofreading which will enable him to operate efficiently in the proofreading of his written compositions.

3. The dictionary is the primary reference tool for such proofreading.[37]

The programme consisted of 14 lessons presented over a 3-week period. The first objective was developed through the use of an introductory film, teacher-led discussions, provision of adequate proofreading time, and progress charts. The second and third objectives were cultivated through underlining words where the spelling was uncertain, practice with dictionary usage in the areas of guide words, alphabetization, and finding synonyms.

The criterion test consisted of a creative writing exercise where the degree of spelling accuracy was measured as a percentage of spelling errors. The subjects were four sixth-grade classes in two schools divided into two experimental and two control groups. The control groups also received instruction in dictionary usage and equal creative writing practice. The only differences were the use

---

[37] Personke and Knight. 1967. (83) p. 769.

of common spelling charts and the emphasis in proofreading techniques provided to the experimental group.

The conclusions stated that boys in the experimental group made significantly fewer errors than those in the control group. No significant difference was found for the girls. The investigators point out that instruction in dictionary usage must be specifically directed towards proofreading if it is to be effective. They also warn that the promising results obtained would be lost unless continuous instruction is provided.

Traditional Attitudes of Educators Towards Proofreading

Reasons for Poor Proofreading Ability

Business educators have attributed low error detection ability to the following causes:

1. Insufficient reading time provided.
2. Student was in a hurry or careless.
3. Lack of knowledge as to what constitutes an error.
4. Student dishonesty - the deliberate overlooking of errors.
5. The student's negative attitude about its importance. Inability to proofread does not result in unduly heavy penalties.
6. A psychological reaction may produce a tendency to overlook errors as they result in lower achievement ratings and indicate

an inability to perform at an acceptable level. On the other hand, students seldom feel successful when they find all their errors. No mark is usually assigned for proofreading achievement.

7. A student's inherent ability to proofread is relatively unchangeable.

8. Students generally type from a perfect copy; the thought content in their own work is taken for granted.

9. Students lack instruction and practice in error detection skills. The programme of studies followed by students operates on the assumption that the students' work will be checked by a teacher or marker. Errors committed and undiscovered by students are not heavily penalized. Students are seldom expected to produce perfect work in any subject area.

10. Instructional materials in proofreading are not readily accessible for teachers to use in the classroom.

11. Physical factors such as fatigue, and external factors such as noise, and inadequate lighting may cause poor proofreading.

Attitudes of Educators

An examination of the attitudes of business educators towards proofreading reveals a spectrum of opinions. The proofreading problem arises most frequently in typewriting and there appears to be an increasing awareness of the complexity of the process.

On one hand some express the opinion that no problem exists and that students can proofread accurately once they have been convinced that they are expected to perform adequately. In a text used in typing method courses, Blackstone and Smith state:

> It is recommended that each student be required, after the initial learning period has passed, to proofread all papers that are to be handed in for grading purposes, and to make the necessary corrections on them. To prevent students from being dishonest or careless in marking their errors, the teacher should sample a few papers from each lot. If the teacher finds any paper that contains one or more errors that have not been corrected, she should demand an explanation from the student. The student might be called up to the desk and asked about the errors. The student may offer one of three possible explanations, first he may say that he did not know the particular point was an error. The teacher might accept this explanation once, provided that the student would agree that he could now recognize that error, and that he would catch and correct all such errors in the future. Second, the student might say that he did not notice the error. The teacher should explain that such carelessness would be fatal in an office and should penalize the student's paper very severely, perhaps requiring that it be completely rewritten. Third the student might admit that he was deliberately dishonest although that is the least likely possibility.
>
> If the student had no reasonable explanation, the teacher might attribute the error either to carelessness or dishonesty. He might then require the student to rewrite the paper, and make him understand that, until he demonstrates that he can be trusted, his papers will have to be carefully checked by the teacher. Before long the student will learn what such a call to the desk means and, they will hesitate to run the chance of having to be called upon to explain unmarked errors. In the process, students can and will learn to proofread.[38]

---

[38] Blackstone and Smith. 1949. (7) p. 296.

Other business educators have recognized that exhortation is insufficient. They have urged business teachers to accept the responsibility of integrating specific instruction on proofreading into subject courses (9, 11, 13, 20, 54, 70, 111). Henning speaks on behalf of another commonly held view that proofreading is simple and that the problem can be easily solved with proper instruction.

> The teacher of typewriting should take a positive approach to the teaching of proofreading in the classroom. It is not sufficient to instruct the students "to proofread carefully." Telling the students to proofread is not teaching the students to proofread. Penalizing for errors is a negative approach, and, as many of us know, yields negative results. Students often deliberately overlook errors in order to avoid the penalty.
>
> If students are taught the correct way to proofread, a great deal of valuable class time will be saved. Too often students spend five minutes typing and the same length of time on proofreading and calculating the speed. At that, they rarely succeed in locating all their errors. With proper instruction, it should take no longer than one or two minutes to proofread and figure the speed on either a five or ten-minute writing.[39]

Lloyd (70), however, writes about the complexity of proofreading and explains why students do not perform adequately.

> It may be that teachers underestimate the actual difficulty of proofreading.
>
> In an error-detecting test given in the past two years to over a thousand business teachers at conventions and regional conferences, a test in which cash awards offered a special motivation, not one business teacher was able to detect all the fifty ordinary errors packed into a 150-word letter.

---

[39]Henning. 1950. (54) p. 28.

> No, proofreading is not easy. The eye has a way of passing over the lines of typescript and seeing what the mind wishes were there instead of what the fingers actually put there. Proofreading, moreover, is nearly always done in haste. The time devoted to proofreading is nonproductive time, and the student feels a compulsion to get on with more result-showing work.
>
> Put together, all these factors add up to a powerful negative total. It is no wonder that our students cannot proofread as well as we wish they could.[40]

W. R. Foster acknowledges the complexity of proofreading, but believes that the problem is beyond solution.

> Now the point of the data is this: People do miss errors. Even experienced printers and professional proofreaders working, under a bonus system and achieving higher results than we should expect of students, do miss errors. Moreover there is considerable doubt as to how much anything we can do can improve the situation. . . my vice-president friend agrees with psychologists and expert proofreaders (as I pointed out twelve years ago) that both good and poor proofreaders inherit their abilities or attain them in relatively unmodifiable form long before they practice proofreading.
>
> The moral of the foregoing is that we should not expect any miracles just by "making proofreading affirmative."
>
> So let's stop trying to be prison guards suspecting all pupils of trying to put something over on us. Let's try becoming their friendly guides to the goal of successful typing. Not making it a crime to check all errors, but rather bad business, robbing the pupils of any thrill of trying to get by--and succeeding at times. And let's not fool ourselves--we cannot see every uncaught typing error any more than our pupils can. Not only is it true that typing teachers do not see typing errors in their own articles, but scientific experiments have proved that 100 percent error checking is, in a practical world, impossible.[41]

---

[40] Lloyd. 1950. (70) p. 335.

[41] Foster. Op. cit. p. 383.

Foster, however, does not cite references that can be investigated for the confirmation of his controversial statement that accurate proofing is impossible. As pointed out in an earlier section (Modification of Proofreading Ability), studies, although few in number, have reported success in improving proofreading efficiency.

Most of the citations presented were written two decades ago, but the statements are still accurate representations of the present situation. A search made of library resources does not indicate that any progress has been made toward the improvement of proofreading ability during this time period.

III. DESIGN OF THE STUDY

Population

The experiment was conducted in Burnaby and Vancouver, the two largest of seven school districts located in the metropolitan area of Vancouver, British Columbia. Vancouver is a major shipping port on the Pacific coast of approximately 1.1 million people and is also the financial, commercial and industrial heart of the province. Nearly 65 percent of the provincial population is concentrated into this southwestern corner of the lower mainland surrounding Burrard Inlet.

Students of these two areas may be described as "urban." Although Burnaby at one time was referred to as "the bedroom of Vancouver" the past decade has witnessed an expansion of industry and the establishment of a university in the district so that it no longer retains the characteristics of a suburban area. Greater Vancouver historically has been one of the most frequently chosen places in Canada for initial immigrant settlement, and every ethnic and national group is represented. Hence the socio-economic background of the student population span all portions of a continuum.

Although the urban residential patterns follow those of other cities where approximate income areas may be defined, the range

of educational services available does not vary greatly. The age of the physical facilities follows the historical settlement pattern of the city. For example, the facilities at Magee High School (a participant in the study located in a middle-upper economic area) are comparable to those at Britannia, located in an industrialized lower-income neighbourhood. New schools have a more modern plant, but students who transfer from one school to another within the area will find equivalent services. Burnaby, being a much younger district provides more uniform facilities in the secondary schools, but again the services are comparable.

Qualified faculty are found throughout the system. Since a provincial curriculum was followed until recent years (when greater flexibility and innovation was encouraged) most students find equal opportunity for education regardless of where they live. The provincial curriculum is historically oriented strongly towards a liberal arts, university preparatory programme with approximately two academic students for every vocational student.

Vancouver was selected as one of the areas in which this study would be undertaken because it was the largest school district and provided the largest population parameter. The student population also was more heterogeneous when compared to the other districts and the data that would be collected would be derived from students of diversified backgrounds. When approval for this experiment was

being sought, it was learned that a Department of Research and Testing operated within the school system. Subsequently it was found that this department was most cooperative and supplied contact and liaison with the numerous people who were involved in the study.

Burnaby was selected because it was the second largest district and because the investigator had taught in the system for many years. The generous cooperation and assistance subsequently received from both districts were extremely gratifying.

Statistical Method of Random Sampling

The total enrollment of secondary students from which the population for this study is derived is shown in Table 1. The population is composed of students who elect to take the beginning typewriting course (designated as Typing 9 provincially) during any year of their grades nine through twelve program. Thus students of grades 9, 10, 11 and 12 may be enrolled in a single class.

The organization of the secondary schools in the two districts differs from each other as far as the grade composition of each is concerned. This factor, however, is not deemed to be significant in this study. Burnaby schools are organized as elementary-junior secondary (grades 1-10), junior secondary (grades 8-10), and senior secondary (grades 11-12). In Vancouver, schools may be designated as elementary-senior (grades 1-12), and secondary (grades 8-12/13).

Table 1. Enrollment of secondary students in Burnaby and Vancouver

	September 30, 1969				
	Grades				
	9	10	11	12	Total
Vancouver	5389	5735	5177	4831	21132
Burnaby	2373	2263			4636
Totals	7762	7998	5177	4831	25768*

*Figures obtained from Burnaby and Vancouver School Boards.

As mentioned in the Limitations section, Grades 11 and 12 students in Burnaby were excluded from the population. During the school year 1969-1970, 1831 students in Burnaby and 4376 students in Vancouver were enrolled in Typing 9 according to data supplied by the two School Boards.

Sampling Procedure

To obtain a representative sample of the student population, the random sampling method used must conform to two criteria. Every individual in the population must have an equal chance of being chosen and the selection of any one subject must not be affected or related to the selection of any other.

The size of the sample selected was based on the following considerations: Mouly (78) points out that the greater the sample size, the greater the presumed accuracy of data obtained therefrom. But the precision of the data is determined by the size of the sample,

not its relative proportion in relation to the population parameter. Guilford (49) states that it is surprising to the uninformed how small a total sample will provide a valid predictive index. It is not so much the number involved but how the sample is composed--in other words how representative it is of the population that has been defined. Guilford also points out that an adequate sample should contain 100 subjects, any less would be considered small.

Other considerations that had to be made in this study concerned access to the population and the disruption caused by its execution to the schools' daily routine. Since the size of the population was large and relatively scattered geographically, the problem of assembling the subjects together had to be met. Hence the selection of subjects and the implementation of the project should be as economical as possible in terms of time and integrated into the regular school routine to the greatest extent feasible.

To meet these criteria, it was decided that subjects would be chosen on the basis of school and class enrollment. Four separate schools from each district were invited to participate. Although the enrollment in Typing 9 classes is sufficiently large so that an adequate number entering the sample could be drawn from a smaller number of schools, it was felt that this larger number would increase the representativeness of the population defined. Two classes from each school would be selected. Thus variation in class size between

schools would be provided for, and simultaneously an adequate number of subjects would be included in the sample.

The investigator decided that the Burnaby group would be administered tests printed on paper of different colours, while the Vancouver group would be administered tests printed on white paper to compare the effects of colour context. It was subsequently found, however, that this arbitrary decision violated the principle of random sampling (as mentioned in the Limitations section) and it was found necessary to use statistical methods to obviate the factor of individual differences between the two groups. No significant difference was established, however, in the statistical analysis.

A list of the eight junior secondary schools in Burnaby and the seventeen secondary schools in Vancouver was compiled (See Table A in Appendix) and arranged in alphabetical order. Each school in each district was assigned a number in descending order. Four schools were selected from the Burnaby list in the order in which the assigned numbers appeared when the investigator entered a table of random numbers. In Burnaby the order of appearance was McPherson Park, Cariboo Hill, Edmonds and Moscrop. The same procedure was followed for the Vancouver schools. The four schools selected in the order of appearance in the table of random numbers were Eric Hamber, Sir Winston Churchill, Lord Byng and Kitsilano. Subsequently when it was found that Kitsilano had declined participation,

the random numbers table was used once more. Any number which had previously appeared was rejected, and the next two numbers that presented themselves were selected. Two additional schools were chosen in the event that one might again decline. The first school chosen, Killarney, gave its consent, and consequently it was found unnecessary to approach the alternative school, David Thompson.

Random sampling procedures continued to be followed in the selection of classes in each school. The timetables of every teacher who taught Typing 9 classes were obtained, and the names of each teacher were arranged in an alphabetical sequence. The class(es) that each taught of Typing 9 was also arranged in an alphabetic sequence conforming to the arrangement that was used in both districts in scheduling timetables. Each class was then assigned a numerical designation in descending order. The two numbers that first emerged in the use of the random numbers table were selected for inclusion in the study. The data used in the selection of classes in Burnaby are shown in Table B of the Appendix and Table C of the Appendix for Vancouver.

A summary of the subjects and their schools participating in the study is shown in Table 2.

Table 2. Composition of sample and the number of useful tests derived for two independent groups

Burnaby Schools	Number of Subjects	Number of Usable Tests
McPherson Park	59	49
Cariboo Hill	75	50
Edmonds	72	52
Moscrop	55	20
Total	261	171
Vancouver Schools		
Eric Hamber	74	36
Sir Winston Churchill	55	44
Lord Byng	69	51
Killarney	60	41
Total	258	172

As indicated, a total of 171 usable papers was obtained from 261 participants in the Burnaby group and a total of 172 usable papers from 258 participants in the Vancouver group. The criteria used in accepting or rejecting a test will be discussed in a later section.

The method of random sampling used in this study is believed to conform to criteria required for proper control subject to the qualifications mentioned. In the presentation of the data, the Burnaby group is referred to as "coloured paper" because the influence of colour was investigated with this group, while the Vancouver group is designated "white paper" because this group wrote tests printed on white paper so that a comparison between the two groups could be made.

Measuring Instruments - Construction of Criterion Tests

The primary variable to be investigated in this study is the effect of repetition on proofreading efficiency in the independent method of error detection in typewriting. To evaluate the proofreading efficiency of the subjects, it was decided that the administration of an objective criterion instrument for measurement would provide the most suitable means of collecting data for the comparison of performance. Since the number of repetitions to be investigated had been designated at three (0, 1, and 2) as the independent variable, three equivalent criterion tests would have to be constructed.

A secondary purpose of the study was to examine the influence of the use of paper of different colours on reading efficiency. This data could be collected readily as the same tests constructed for the realization of the primary objective could be duplicated on paper of different hues and administered to a separate group.

To measure the subjects' proofreading achievement in beginning typewriting with any degree of validity, the measuring instruments used must be representative of and comparable in difficulty to the materials that the students actually use in their class work. In addition, it was necessary to define the situations in which students are asked to demonstrate their proficiency in proofreading in a beginning course. From past experience in teaching the course, the investigator

believed that the proofreading of timed writings of varying time lengths to determine the typing speed rate constituted the most frequently recurring situation where students are asked to demonstrate their skill in error detection. Initially the amount of material proofread is small since the time intervals of the first tests are short, but gradually as the class advances, the time lengths of the tests begin to get progressively longer. In addition as students develop their typing ability, the amount of copy that they produce gradually increases; thereby increasing the amount of material that they must proofread. In other words the basic variables that determine the amount of copy which a student must proofread in a timed writing are determined by the number of minutes and the student's typing rate.

The best material available that is representative of copy students actually use was assumed to be found by examining the textbooks used in the beginning course. The Course of Studies issued by the Department of Education recommends the utilization of three textbooks in Typing 9 and Typing 10 (the first and second courses in typewriting), and since these are available through the provincially operated textbook rental plan, they are found in every school. These three texts are listed in alphabetical order of author' names:

1. McConnell, Jean M. and William L. Darnell. Building typing skills book 1. Canadian ed. Toronto, McGraw-Hill, 1962. 169 p.

2. Rowe, John L. and Faborn Etier. Typewriting drills for speed and accuracy. Canadian ed. Toronto, McGraw-Hill, 1967. 90 p.

3. Wanous, S. J., B. Hagg blade and Willis B. Glenn. Personal typewriting. Canadian ed. Toronto, Gage, 1967. 243 p.

The first and third books are comprehensive texts, offering instruction in all phases of skill development. The second is a book of drills with material for timed writings. Proofreading per se is not presented as a separate subject in any of the three texts although the students are asked to calculate their typing speed rates in the tenth lesson of the first book and in the seventh lesson of the third book. The most closely related topic is the instruction given in proofreader's marks used in the typing of rough draft copy.

Originally consideration was given to the extraction of randomly selected passages from the three books to be used as the measurement instruments. In addition, manuscripts published by typewriter manufacturers and others found in the professional journals for business educators were considered. The inability to control the variable of familiarity made the rejection of these sources advisable.

Under the circumstances it appeared that adequate control could only be obtained through the construction of test material that

was representative and equivalent in terms of reading difficulty to the materials found in the three prescribed textbooks.

Number of Measuring Instruments

To investigate the variable of repetition in proofreading the number of tests to be used had to be determined. The study proposed to examine the influence of reading copy with 0, 1, and 2 repetitions. Accordingly the question was whether one or three tests should be used. A single test could have been administered with three sets of reading directions, but it was felt that the factor of familiarity would be influential, since all tests would have to be written by the subjects within a relatively short period of time. Consequently it was decided that three equivalent tests would be desirable.

Form of the Measuring Instruments

After an examination was made of the materials found in the three texts where students are asked to proofread prior to calculating their typing rates, it was decided that the measuring instruments should take the form of narrative (manuscript) passages. The manuscript form is the most commonly used material for sustained timed writings where students are required to proofread.

Length of Tests - Quantity of Copy Selected

The maximum time recommended for tests of speed and accuracy in beginning typewriting by the provincial Course of Study is five minutes. Consequently the investigator decided that the quantity of copy should approximate the maximum amount that a student is likely to produce on a timed test of five minutes.

Experienced teachers of beginning typewriting classes are well aware that the typing ability and progress of the students will vary extensively. Although theoretically the students are novices, it cannot be assumed that they are completely unknowledgeable. Some will have received instruction at home about touch-typing techniques, others may have used the machine for some years using hunt-and-peck techniques, and a few will have had no contact at all with the machine. As the class advances along the course, differences in stroking and reading ability will result in wide variation in the rates of progress found. This difference in ability manifests itself from the first lesson and is sustained throughout the course. Hence the amount of copy that each will produce in timed tests will vary widely.

The provincial Course of Study contains a marking scale that is recommended (but not mandatory) for use in Typing 9. It suggests that teachers use it as a guide, adhering to the minimum rates for promotional purposes with adjustment to higher rates if this was

deemed desirable. This scale is based on a 5-minute timed writing with a 10-word penalty for errors. The rate for an A grade is 37+ net words per minute at Easter and 40+ net words a minute in June. Since a net word rate includes a penalty for errors, the gross-word count will be higher. Using this information it was decided that the measuring instruments should contain 300 words, which is calculated at a gross typing rate of 60 words per minute. This figure provides a margin of safety since it is impossible to predict how a net rate will be determined because the two variables of gross words and errors can change from timing to timing. It is acknowledged that occasionally a beginning student will type at a higher rate than 60 gross words per minute, but these are exceptional cases.

Subject Content of Measuring Instruments

To determine the subject content found in the timed writing copy in the three prescribed texts, the investigator read the passages. An attempt to classify the topics did not produce any useful tabulation because the subject matter was too generalized and diverse. Examples of content include vacations, the use of money, sports, technique reminders, and leisure reading. It appeared that the best description that could be made would be to say that the topics most frequently encountered were business related subjects. Hence it was decided that the subject topic of the measuring instruments was not an

influential factor. In order to make the tests as representative as possible, three business related subjects were arbitrarily selected. The first test dealt with "typing posture," the second with "economics," and the third with "job interview."

Level of Difficulty

The measurement of readability or level of difficulty of written materials may be achieved by using any of the readability formulas that have been found to be valid and reliable. The Flesch formula meets these criteria (17). The Flesch formula differentiates difficulty and assigns reading levels to printed matter on the basis of two variables: average sentence length and the total number of syllables. The criterion of difficulty is the McCall-Crabbs standard. The reading levels shown on this standard represent the grade level equivalent for a group of readers who answered correctly half of the test questions for a given passage of material. The Flesch formula discriminates difficulty among materials at higher levels, but does not perform as well below the fifth grade.

Instructions for the use of the Flesch formula have been prepared by the Department of Education at Oregon State University and are shown on pages 144-5. These instructions were followed to determine the grade level of reading for the three prescribed texts used in Typing 9. The analysis used for PERSONAL TYPEWRITING

is shown in Table D of the Appendix, for BUILDING TYPING SKILLS in Table E, and for TYPEWRITING DRILLS FOR SPEED AND ACCURACY in Table F. A summary of the reading levels for these texts is shown in Table 3.

Table 3. Readability levels of three prescribed textbooks

	Personal Typewriting	Building Typing Skills	Typewriting Drills for Speed and Accuracy
Number of Samples	24	16	18
Average Sentence Length in Words	11.267	14.952	18.369
Average Syllable Count per 100 Words	133.208	143.065	143.944
Readability Index (Grade Level of Difficulty)	6th grade	7th grade	8th grade

After the readability levels had been calculated, it was decided that the measuring instruments should range between grades six to eight in difficulty. The two variables used in the Flesch formula of sentence length and syllable count should fall within the upper and lower limits as determined by the analysis of the three texts. This would be:

Average sentence length in words: 11.267 - 18.369

Average syllable count per 100 words: 133.21 - 143.94

The criterion tests were then written and the Flesch formula was applied to the passages. Where necessary, sentences were shortened

and/or lengthened, and suitable synonyms were substituted. The smooth flow of narrative prose was considered the primary objective in the writing and any revision made to adjust readability levels should not unduly impede the attainment of the major aim. The analysis of the data used in the application of the Flesch formula for word count, sentence length, and syllable count is shown on pages 174-176 for test 1, pages 177-179 for test 2, and pages 180-182 for test 3. Table 4 on the following page shows a comparison of the analysis used in the three tests against that of the three prescribed textbooks. The variables of sentence length and syllable count fall within the defined range of acceptability so that the tests are equivalent in reading difficulty to the three texts.

Error Load in Measuring Instruments

The decision that must be made in this critical area of any investigation concerns the determination of the types of errors and the frequency at which the criterion instrument is to be loaded. Under-loading may yield little usable data while over-loading may result in the loss of reader comprehension and context--two major variables of reading efficiency. In addition, any error detection study should take into account the accuracy level at which students are asked to demonstrate their proofreading ability in typewriting--in other words, the approximate number of errors which they are

Table 4. A comparison of the level of difficulty of three tests and the three prescribed textbooks using the Flesch Formula for readability.

	Personal Typewriting	Building Typing Skills	Typewriting Drills for Speed and Accuracy	Test 1	Test 2	Test 3
Sentences per 100 words	8.875	6.688	5.444	7.000	7.333	7.666
Average sentence length in words	11.267	14.952	18.369	14.286	13.643	13.044
Average syllable count per 100 words	133.208	143.065	143.944	137.000	136.333	133.666
Sentence length x 1.015	11.436	15.176	18.644	14.499	13.847	13.239
Syllables x .846	112.693	121.031	121.777	115.902	115.337	113.081
Total raw score	124.129	136.207	140.421	130.401	129.184	126.320
Constant	206.835	206.835	206.835	206.835	206.835	206.835
Less raw score	124.129	136.207	140.421	130.401	129.184	126.320
Difference	82.706	60.628	66.414	76.434	77.651	80.515
Grade level of difficulty	6th gr.	7th gr.	8th gr.	7th gr.	7th gr.	6th gr.

likely to encounter. The review of the literature for this study provided a useful guide in the consideration of these factors.

Attention was given to the effect of the error load used in the Crosland, Foster, Ewart and Staples reports. It was decided that further study should be made of the Staples and Ewart lists since these had been formulated for use in typewriting. The former did not report the rank order of errors undetected while the latter provided this information. In addition an analysis was shown of the rank order of error types committed by the respective subgroups in the survey. It was noted that the groups defined for this investigation, namely junior and senior high school students in beginning typewriting classes had recorded a higher inaccuracy score in respect to the same seven categories of errors, although the rank order for each was different. Consequently it was decided that these same seven error types should be used for the present study. These error types are:

1. Doubling of small words or of syllables within a word
2. Omission of a letter within a word
3. Omission of one of a pair of doubled letters
4. Transposition of letters within a word
5. Spacing errors - omission of a space and extra spaces
6. Substitution of one small word for another
7. Transposition of words within a sentence

The second determinant of error load is the frequency or the number of times that an error is written into a test. Only the Ewart survey indicated the control of this variable. Eight of the ten error classes were repeated four times and two error classes twice. Before the frequency rate was set for this present study, however, the investigator thought it necessary to take into account the findings of the Nellermoe study. It was reported that students averaged approximately 6 to 6.5 errors per 100 words of copy during the tenth and seventeenth weeks of instruction as mentioned previously. Another factor to be considered is the inclusion of the influence of location in the study. If only halves of page are to be analyzed, the frequency rate is 2, but if quartiles are used, the frequency rate would increase the total error load at a geometric rate.

Thus in setting the total error load, some type of subjective judgement and compromise must be exercised. The weight assigned to the various variables under investigation and the effect upon the primary problem of the study must be considered. An examination of earlier studies may be useful to compare the effect of error load from two points of view. In the following summary, error load is first considered in its use as an independent variable (established by the researcher) and second as a dependent variable (derived from the findings of the researcher).

Error Load as an Independent Variable	Error Load per Test
Staples	235 errors - 5 page test
Ewart	38 - 369 words
Error Load as a Dependent Variable	
Nellermoe	Approximately 6 per 100 words

There is no way of determining the error load used in the Staples study, but the figures from the Nellermoe and Ewart reports indicate that the number may range roughly from 10 errors per 100 words to 6 errors per 100 words.

At this point it was felt that a subjective classification of the order of importance of the variables used in the study that influenced error load would provide a more useful guideline. These are:

1. Error type or category
2. Accuracy level of beginning typist - the number of errors one is likely to be required to detect on a five-minute timed writing
3. Frequency rate
4. Location of errors

In view of the decision made to use seven types of errors, the frequency rate set could vary from 1 to 5 before the maximum rate of 10 errors per 100 words was reached. The accuracy level however, suggested a much lower figure. The alternatives available using different rates of frequency are:

Frequency Rate	Total Error Load
1	7
2	14
3	21
4	28
5	35

As the total number of words in each test had been set at 300 on the basis of the students' gross stroking rate, it was apparent that the frequency would have to be set at either 2 or 4 in order to relate the influence of error type to location. Loading the tests at a frequency rate of 2 meant that each would contain 4.7 errors per 100 words, while a frequency rate of 4 meant 9.3 errors per 100 words. Subsequently the total error load was arbitrarily set at 2 because the error ratio is closer to the Nellermoe figure. The error load for each test is shown on pages 183, 184, and 185 respectively.

Location of Errors

The decision to use a total error load of 14 meant that findings pertaining to error type could not be related to location. A minimum frequency rate of 4 would have to be used for even a locational analysis based on half pages. Therefore, it was decided arbitrarily that each error type would be presented twice, one on the upper half of each test and again on the lower half. No special attempt would be made to locate errors on the basis of vertical position. It would be possible, however, to determine the influence of location on the basis

of total errors undetected by subjects using a percentage basis. An analysis could be made in respect to location by vertical and horizontal quartiles. The error load by quartiles is shown on page 173.

Test Instructions

The final step in test construction was the writing of instructions. The influence of repetition was examined by preparing three different sets of reading instructions. Subjects would be asked to proofread the tests using three procedures. In the first, the subjects would be instructed to read the copy once, circling errors as they encountered them (0 repetition). No re-reading would be permitted. In the second, the subjects would read the test once, then circle errors on the second reading (1 repetition). In the third, the subjects followed the same procedure used in the second, but would be permitted to read the test another time, circling any errors that they missed on previous readings (2 repetitions).

For the purpose of control a random numbers table was used for the assignment of the reading methods to the three tests. The tests were first assigned a number based on the alphabetical order of the subject topic:

1. Economics
2. Job interview
3. Typing techniques

Then they were reassigned test numbers designated on the order in which the numbers appeared in the use of the table of random

numbers. Subsequently the first numerical classification of the tests showed the following order:

Test 1 - Typing techniques

Test 2 - Economics

Test 3 - Job interview

Next the reading procedures were assigned numbers on the basis of the rate of repetition:

1. 0 repetition
2. 1 repetition
3. 2 repetition

The table of random numbers were entered again and the reading procedure was matched to each test in the order in which they appeared. This resulted in the following combination:

Test	Reading Procedure
1	1
2	3
3	2

To determine the order in which the tests would be administered the table of random numbers was used again. The order of emergence was:

Test	Reading Procedure	Order of Administration
1	1	1
3	2	2
2	3	3

The tests were given a final reassignment of letters (A, B, and C) on the basis of the order of administration.

It is believed that the procedures followed provided the control that is required through randomization so that any bias that would be found in matching the reading procedures to the tests would fall within the range of sampling error.

Time Factor

The review of the literature indicated that conflicting findings in earlier studies had been reported. A basic question must be considered about the time factor variable. Should time be regarded as an independent or dependent variable?

In Staples' study where time was treated as an independent variable, the subjects were allowed five minutes to proofread five manuscript pages. In both Crosland and Ewart's studies, where time was treated as a dependent variable, no time limit was set, although in the latter it was suggested that the test should take approximately ten minutes to read 369 words. As noted earlier, even this suggestion was sufficient to have caused some participants to complain that their

reading accuracy had been adversely affected. This effect on proofreading efficiency is critical for in spite of claims that "normal classroom proofreading is also hurried" it would seem that the lack of sufficient time would in itself defeat the primary objective of proofreading--that is, the detection of errors so that work can be verified as accurate.

In addition there is little information available about proofreading rates per se. Foster mentions 40 words per minute as an average for professional typographers. The Ewart survey reported on the reading times for high school groups where the range was found to extend from under 3 minutes to over 13 minutes with a median of 6 to 6-3/4 minutes. This can be calculated and stated as a median proofreading rate of approximately 61 words per minute. But an examination of the rates of the college group where a median rate of 3 to 3-3/4 minutes were reported meant that these subjects read at approximately 100 words per minute. This wide range of variability makes it extremely difficult to establish a suitable proofreading rate with any degree of confidence. Therefore it was decided that for this study, time would be treated as a dependent variable and subjects would not be limited to any extent as far as this factor was concerned.

The subjects would be asked to report the time that each used in terms of half minutes. The administrator of the test would be

asked to write the time every half minute on the chalkboard after the subjects begin the test. All subjects would begin each test at the same starting time.

Effect of Colour

With the increasing use of different coloured duplicating papers, it was decided that the influence of a coloured background would be investigated. This could be undertaken by printing one series of the three tests on paper of different hues, and another series in a neutral colour or white. The effect of colour could be investigated by the comparison of the data obtained from one series to the other.

When the interrelated variables of hue, value, and brightness are considered, the range of available colours is vast. Seven spectrum hues are usually included in a full colour range, but when the factors of value and brightness are combined in different proportions, the characteristics that can be ascribed to a specific spectrum hue can change radically. Therefore, a decision was made to reclassify the colours from the customary differentiation based on spectrum wave length value into a simpler categorization based on the influence which a colour would exert on the readability of printed material. These are defined as:

1. Illuminating colours - those colours that assist the reader in the visual task of reading, e.g. by increasing the degree of

contrast between the colour of the ink and the background, and those which increase the reader's interest and motivation to read the material.

2. Neutral colours - all shades of white would be considered to have neither an assisting or disabling effect.

3. Unilluminating colours - those that hinder the reader in the visual task of reading, e. g. colours that increase fatigue by producing an irritating or overstimulating effect, and/or those that generate unpleasant associations to the reader.

For this study, yellow was chosen to represent an illuminating colour, as the tint value was believed to heighten the ink contrast. White was used as a neutral colour, while green represented an unilluminating colour because its shade value would decrease the contrast between the ink hue and the colour of the page.

Format of Tests

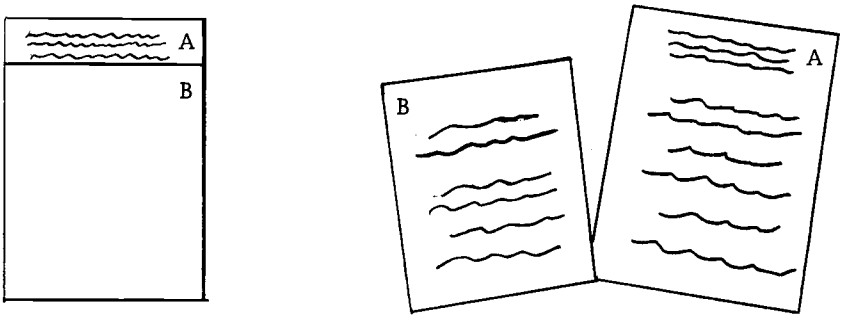
In the proofreading studies in typewriting that have been conducted, the subjects were asked to write tests into which errors had been loaded. But they did not know and did not have access to the original or correct copy, and had to read simultaneously for thought content that was derived indirectly from the material supplied, and for typographical errors. The investigator believed that the inaccessibility of the original material did not represent actual classroom

or business practice where one is asked to detect errors without knowing what is correct or incorrect in advance. Consequently it was decided that an "original" or correct copy should accompany each test.

The subjects would read the original before starting the test and would be allowed to refer to it throughout the time interval required to complete the test. The time recorded by the subjects for test completion would not include the reading time utilized in perusing the original. It would, however, include the time used in referring to the original after starting the test. This procedure was believed to be more representative of actual proofreading practice. While work is being checked, one refers to the correct copy when errors are found, very often simply to verify that the word under scrutiny is a mistake!

As a result, each test consisted of two pages with the original printed on letter-sized sheets and the test on legal-sized sheets. The original was stapled face down onto the test so that the test administrator could check visually to see if the subjects were following instructions. Procedures will be discussed in a later section, but this diagram shows the format used in stapling to produce each test unit.

Test (2 pages - closed) Test (opened)



A - test - reading directions are visible when closed

B - original or correct copy

General Instructions for Subjects and Administrators

It was believed that a greater degree of control would be established if standardized procedures were available in printed form for test instructions for both subjects and administrators. It was believed necessary to stress to the subjects that participation in the study would not affect their grades. The test administrator was asked to read the direction sheet for students orally at the beginning of each test. A copy of the direction sheet for students is shown on page 186.

The direction sheet for test administration showed six sequential steps to be followed. In addition the administrators were asked to demonstrate the handling of the test pages so that a visual check could be made if subjects were handling the sheets correctly. The direction sheet for administrators is shown on page 187.

Procedures

Test Administration

Permission was first obtained to conduct the study in Burnaby through a written application to the District Superintendent of Schools. Approval was granted with the proviso that permission be sought from the principal of each school. The schools were then selected randomly and the Director of Secondary Education assisted the investigator by contacting the principals. Once more permission was granted with the stipulation that participating teachers and department heads assented. The investigator then contacted department heads and obtained copies of the timetable for every teacher of Typing 9. After two classes had been selected randomly interviews were arranged with the department head and/or teachers.

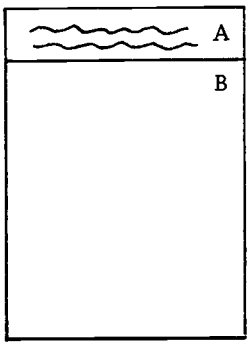
At these interviews all arrangements for the administration of the three tests were made. To economize on time and to minimize the disruption to school routine, the tests would be completed during three successive periods. The period that testing began was not considered a critical factor because different methods of scheduling did not permit the tests to be administered simultaneously within any classroom period at a number of different schools. As long as tests were written within an approximate time interval of two weeks for

all schools, it was believed that no bias would appear in the data obtained from the time factor. For the purpose of control of extraneous factors to the greatest extent practical, however, it was stipulated that the second and third tests would be completed during the succeeding two periods that the class met according to the school's timetable.

Test administrators were advised not to ask students who were absent to take the test missed after they returned because it was believed that the influence of uncontrolled variables might operate when the subjects completed the test in an isolated environment. The tests were to be administered on a class basis. This procedure relieved the administrator of the necessity of keeping attendance records and making arrangements for the completion of the tests at a later time. In using this method of administration throughout the study, it is believed that the factor of subject absenteeism would fall within the range of sampling error for the purpose of control.

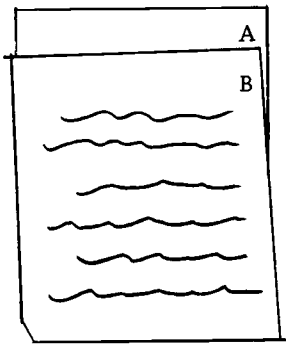
The investigator asked administrators to adhere to the following procedures during each period a test was written. First the test directions for students was read aloud by the administrator. Then the subjects were asked to fold the test unit so that only the original would be visible. After the reading of the original was completed, each subject replaced the page to its original state to indicate that he had finished. When all subjects had terminated their reading, the

administrator would then review the reading directions printed at the top of the test. The starting signal would be given and the subjects would begin to take the test. The administrator would simultaneously begin to record the time in half minutes on the chalkboard. The same starting timepoint had to be used if proofreading time was to be recorded, and this procedure enabled the administrator to know when all subjects were ready to start. After each subject completed the test, he wrote the last time figure appearing on the chalkboard into the space provided in the test. The student then replaced the sheets of the test unit into their original state indicating that he had finished. Students were permitted to refer to the original any time they wished as they were taking the test. The positions of the sheets of the test unit at each step of the test administration is shown below:



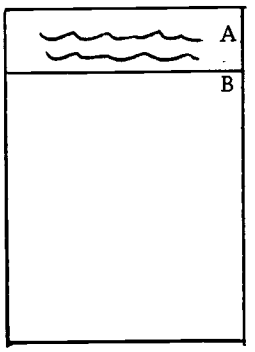
Step 1

Test unit intact - only reading directions visible



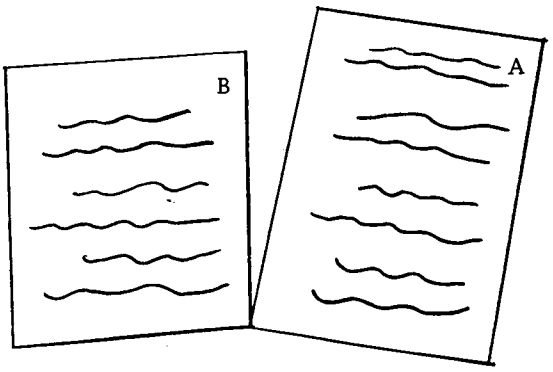
Step 2

Test unit with only original visible as subject begin preliminary reading



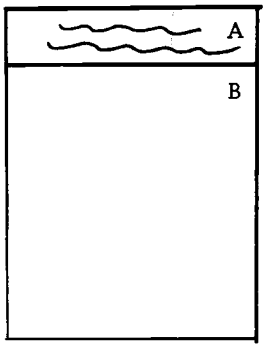
Step 3

Test unit intact indicating the preliminary reading is completed



Step 4

Both original and test are visible as subject writes the test



Step 5

Test unit intact indicating that subject has finished

A - test

B - original or correct copy

A similar procedure was followed in the Vancouver schools where department heads acted as test administrators. Students in Vancouver were asked to supply biographical data relating to class and grade. The tests were taken from the middle of November to the beginning of December, 1969 in Burnaby; during the month of January, 1970 in Vancouver. The enthusiastic cooperation shown by the teachers and the personnel of the Burnaby and Vancouver School Boards was extremely gratifying to the investigator.

Treatment of the Data

Marking Procedures

After the tests were collected from each school, they were arranged in alphabetical order by the names of the subjects. Test papers were rejected for those who had missed one or more tests, or had not recorded the proofreading time. A total of 171 subjects in Burnaby and 172 subjects in Vancouver provided usable tests--a total of 1029 papers.

A marking key was prepared for each test with the errors cut out of a sheet of cardboard that conformed to the dimensions of the test. This type of key masked the portions of the tests where errors were not found and prevented the correct words which had been circled as errors by the subjects from showing. As mentioned

earlier, no suitable method of taking these types of errors into account had been devised and subsequently they were not considered. A different colour was used to identify each of the seven error types used. The number of undetected mistakes was recorded onto a marking summary sheet shown on page 188, where designations were provided for the recording of error type, proofreading time, total errors per vertical and horizontal quartile, and biographical data for the Vancouver group. The IQ and reading scores from standardized tests for both groups, as well as biographical data for Burnaby subjects, were extracted from the Progress Record Cards during the Christmas and Easter vacation periods. Later it was decided that reading scores from standardized tests should be excluded from the statistical treatment because insufficient information was available. Immediately after all available IQ and reading scores had been recorded, the identification of each subject was changed from a surname to a numerical designation. The IQ and reading score of each subject are regarded as confidential information by the respective School Boards and the investigator had agreed to destroy all evidence linking this information to the names of the participants at the earliest opportunity. This was achieved by cutting out and destroying the names of the subjects from the marking summary sheets--a more effective method it was found, than blotting out the names with India ink. When the marking summary sheets had been completed for each subject, the errors

recorded on a locational basis (vertical and horizontal) were changed to a percentage basis. All data collected was then transferred onto coding sheets so that a computer could be utilized in the treatment of the statistics.

IV. STATISTICAL TREATMENT AND INTERPRETATION OF THE DATA

General Definitions

The presentation of the data is reported on the basis of the performance of two independent groups, one representing the block who wrote the series of tests printed on paper of different colours, hereafter referred to as "Coloured Paper." The other represents the block who wrote the series printed on white paper, hereafter described as "White Paper." The tests are referred to in terms of the number of repetitions contained in each, with tests A, B, and C, designated as 0, 1, and 2 respectively.

Definition of Dependent Measures

Proofreading performance was measured in terms of:

1. Time. A subject's time measure represents the total time in terms of minutes required to complete each of the three criterion tests.

2. Total Errors. A total of 14 errors--two of each of the seven types chosen for the study were written into each test. A subject's total error score represents the number of mistakes that were missed or undetected out of the fourteen selected. Although some

subjects made additional errors by indicating correct words as inaccuracies, these were not considered.

3. Number of Errors by Type. Two errors of each of the following seven types were combined and loaded into each test:

A. Doubling of small words or of syllables within a word.

B. Omission of a letter within a word.

C. Omission of one of a pair of doubled letters.

D. Transpositions of letters within a word.

E. Spacing errors - omission of a space and extra spaces.

F. Substitution of one small word for another.

G. Transpositions of words within a sentence.

A subject's type of error score represents the number out of the two errors of each type that was missed on each test.

4. Number of Errors by Vertical Location. Each test was divided into vertical quartiles numbered consecutively from the left side of the page. Appendix G shows the number of errors found in each quartile for each test. A subject's score represents the mean percentage of errors undetected in each vertical quartile.

5. Number of Errors by Horizontal Location. Each test was also divided into horizontal quartiles numbered consecutively from the top of the page. The number of errors found in each quartile is shown in Appendix G. A subject's score represents the mean percentage of errors missed in each horizontal quartile.

Statistical Control

Since the assignment of subjects to each of two treatments (coloured paperand white paper) was not done at random, the statistical control of individual differences via the use of a covariate is desirable. To this end IQ scores of 254 students sampled in the present study could be used as a covariate in the analysis of variance of the five proofreading performance variables, in evaluating the effects of the colour of paper, repetitions, types of errors, and location of errors.

Table 5 presents the mean IQ, the total amount of time in minutes, and the total number of errors for the two treatments.

Table 5. Me an IQ, total amount of time/minutes, and total number of errors for two independent groups

		0 Repetion	1 Repetition	2 Rep etitions
Coloured Paper	IQ	4.49 *(127)		
	Time	3.30 (127)	3.13	3.76
	Errors	5.56 (127)	4.35	4.66
White Paper	IQ	4.42 *(127)		
	Time	2.76 (127)	3.14	4.03
	Errors	5.28	4.13	3.95

*Indicates the number of subjects who had IQ scores available.

Multivariate analysis of covariance was performed on the total amount of time and the total number of errors with IQ scores as a

covariate. The result of testing the hypothesis that IQ scores are significantly related to the two dependent variables (time and total number of errors) is not confirmed, approximate $\underline{F}_{(2, 502)} = 2.229$, $p > .05$. (See Appendix H.)

Although IQ scores were found to be a nonsignificant covariate, it is still possible that the two independent groups of subjects (127 Ss for coloured paper and 127 Ss for white paper) may be different with respect to the individual differences in terms of IQ scores. Mean IQ scores of the two groups were compared. An analysis of variance was performed on the IQ scores of the two groups presented in Table 5, and the analysis indicates that there is no difference between the two groups in terms of IQ, (see Appendix I) $\underline{F}_{(1, 252)} = .138$, $p > .05$).

An attempt was made to check on possible grade differences in terms of time and error scores. There were grade differences in terms of the time measure, but without any meaningful regular patterns of differences, ($\underline{F}_{(6, 731)} = 43.06$, $p < .01$). On the other hand, there was no grade difference in terms of the error measure. ($\underline{F}_{(6, 737)} = 1.73$, $p > .05$).

Because it was found that the IQ scores could not be useful as a covariate in the present study, those subjects whose IQ scores were not available were included in the subsequent analysis of the five dependent variables so that each independent group contains 171 subjects. (One subject had been randomly deleted from the White Paper groups so that both groups would contain the same number for the purpose of comparison of the data.)

Analysis of Data Concerning the Effect of Coloured Paper and Repetition in Terms of Total Amount of Time

Proofreading performance in terms of mean reading time is shown in Table 6.

Table 6. Mean total time/minutes of two independent groups

		0 Repetition	1 Repetition	2 Repetitions	Mean
Coloured Paper	(n = 171)	3.37	3.15	3.78	3.43
White Paper	(n = 171)	2.84	3.19	4.19	3.40
Mean		3.11	3.17	3.99	3.42

MS error between = 322.505

MS error within = 75.677

An analysis of variance was performed on the data, which yielded the results given in Appendix J.

The main effect due to the paper condition is not significant, $\underline{F}_{(1, 340)} = .0635$, $p > .05$.

The main effect due to repetition is significant, $F_{(2, 680)} = 109.1139$, $p < .01$; which means that on the average the treatment with 2 repetitions took longer than that with 0 or 1 repetitions.

Interaction effect between paper and repetition factors, which is of primary interest here, is significant, $\underline{F}_{(2, 680)} = 25.7223$,

$p < .01$. This means that given 0 repetition, the coloured paper took a longer time than the white paper, and given the treatment of 1 repetition, the two paper conditions took about the same time, whereas given the treatment of 2 repetitions, white paper took longer to proofread, as can be easily seen in Table 6.

The range of proofreading time recorded per test was 1 - 9 minutes.

Analysis of Data Concerning the Effect of the Mean Total Number of Errors

Proofreading performance in terms of mean total number of errors is shown in Table 7 and Figure 1.

Table 7. Mean total number of errors of two independent groups

		0 Repetition	1 Repetition	2 Repetitions	Mean
Coloured Paper	(n = 171)	5.596	4.333	4.649	4.859
White Paper	(n- 171)	5.280	4.035	3.994	4.437
Mean		5.439	4.184	4.322	4.648

MS error between = 8.899

MS error within = 2.195

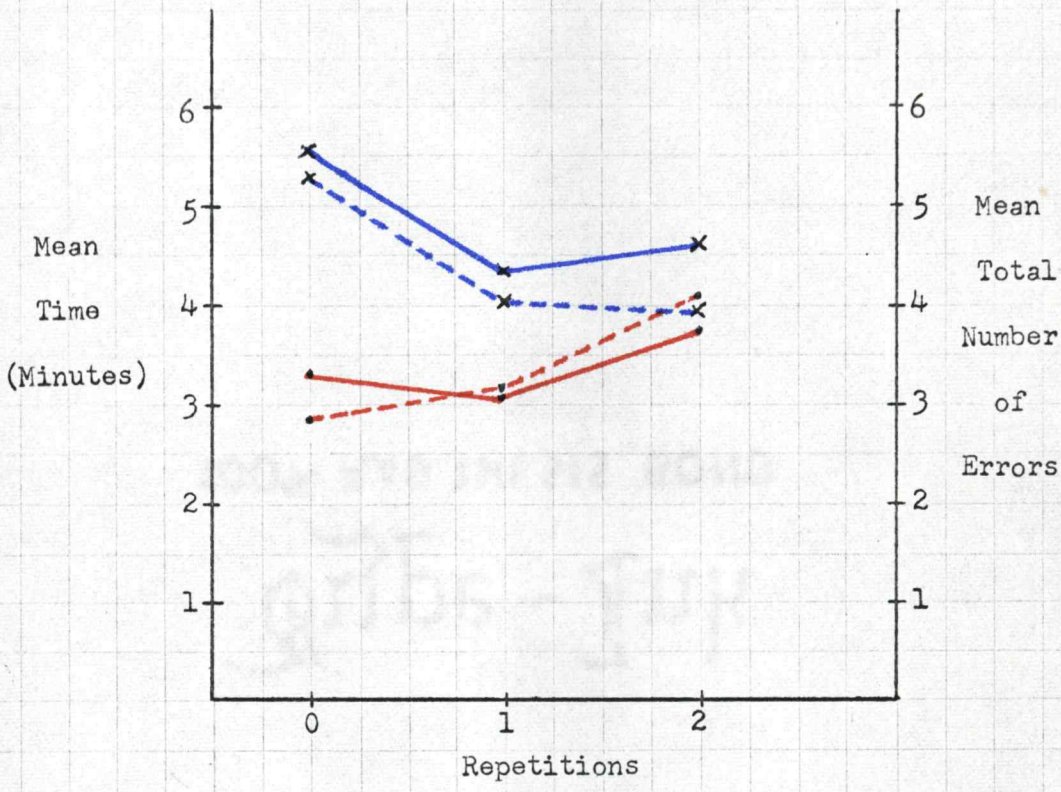


Figure 1. Mean Time And Mean Total Number Of Errors As A Function Of Repetition

Coloured Paper ——

White Paper ----

Errors

Time

An analysis of variance was performed on the data, which yielded the results given in Appendix K.

The main effect due to the paper condition is significant, $F_{(1, 340)} = 5.1571$, $p < .05$; which means that in general, more errors are found, or more accurate proofreading is performed on material printed on white paper over paper of different colours in terms of total errors.

The main effect due to the treatment with repetition is significant, $F_{(2, 680)} = 73.7409$, $p < .01$; which means that on the average when paper of different colours is used, the treatment with 1 repetition results in the most accurate level of proofreading in terms of total errors, closely followed by that with 2 repetitions. When white paper is used, the accuracy rates between those treatments of 1 and 2 repetitions are very similar. But when 0 repetition is given, the level of inaccuracy rises sharply in both situations. The data suggest that the treatment with 1 repetition is advantageous over that with 2 repetitions in terms of total errors in view of the additional rate of accuracy gained and time used in reading.

The interaction effect between paper and repetition factors is nonsignificant, $F_{(2,680)} = 1.5749$, $p > .05$.

The range of inaccuracy extended from 0 - 12 errors per test (0 - 85.7%). All errors were detected on 8 tests; 2 for test A, 3 for test B, and 3 for test C.

Analysis of Data on the Effect of Error Type

Proofreading performance in terms of mean number of errors by type is shown in Table 8 and Figure 2 on the following pages.

An analysis of variance was performed on the data, which yielded the results given in Appendix L.

The main effect due to the paper condition is significant, $F_{(1, 340)} = 4.6985$, $p < .05$; which means that on the average, the use of white paper lowers the level of inaccuracy of the mean total errors by type over the use of coloured paper. With respect to individual error types, the aforementioned is also applicable to types 2, 3, 4, 6, and 7. The level is about the same for type 1, but increases for type 5.

The main effect due to the treatment of repetition is also significant, $F_{(2, 680)} = 77.2212$, $p < .01$; which means that on the average, the treatment with 1 repetition results in the highest level of accuracy in terms of total mean errors by type, closely followed by that with 2 repetitions. A substantial increase is recorded once more with 0 repetition.

Another main effect arises from the factor of type of error and is also significant, $F_{(6, 2040)} = 289.9219$, $p < .01$; which means that on the average, the rank order of inaccuracy for the seven types included in the study is 7, 5, 6, 3, 2, 1, and 4 respectively. It is seen

Table 8. Mean number of errors by type for two independent groups

	Number of Repetitions	Error Type* 1	2	3	4	5	6	7	Mean
Coloured Paper (n = 171)	0	.743	.287	.918	.310	.883	1.158	1.292	.798
	1	.140	.298	.526	.386	.760	..754	1.462	.618
	2	.374	.749	.263	.491	.930	..573	1.170	.650
	Mean	.419	.445	.569	.396	.858	.828	1.308	.689
White Paper (n = 171)	0	.719	.398	.713	.322	.871	1.076	1.175	.754
	1	.129	.240	.404	.333	.784	.789	1.310	.570
	2	.427	.620	.199	.351	.953	.456	.994	.571
	Mean	.425	.419	.439	.335	.869	.774	1.159	.632
	Mean of Means	.422	.432	.504	.366	.864	..801	1.234	.661

*Type 1, 2, 3, 4, 5, 6, and 7 each stands for doubling of small words or syllables within a word; omission of a letter within a word; omission of one of a pair of doubled letters; transposition of letters within a word; spacing errors--omission and extra space(s); substitution of one small word for another; and transposition of words within a sentence respectively.

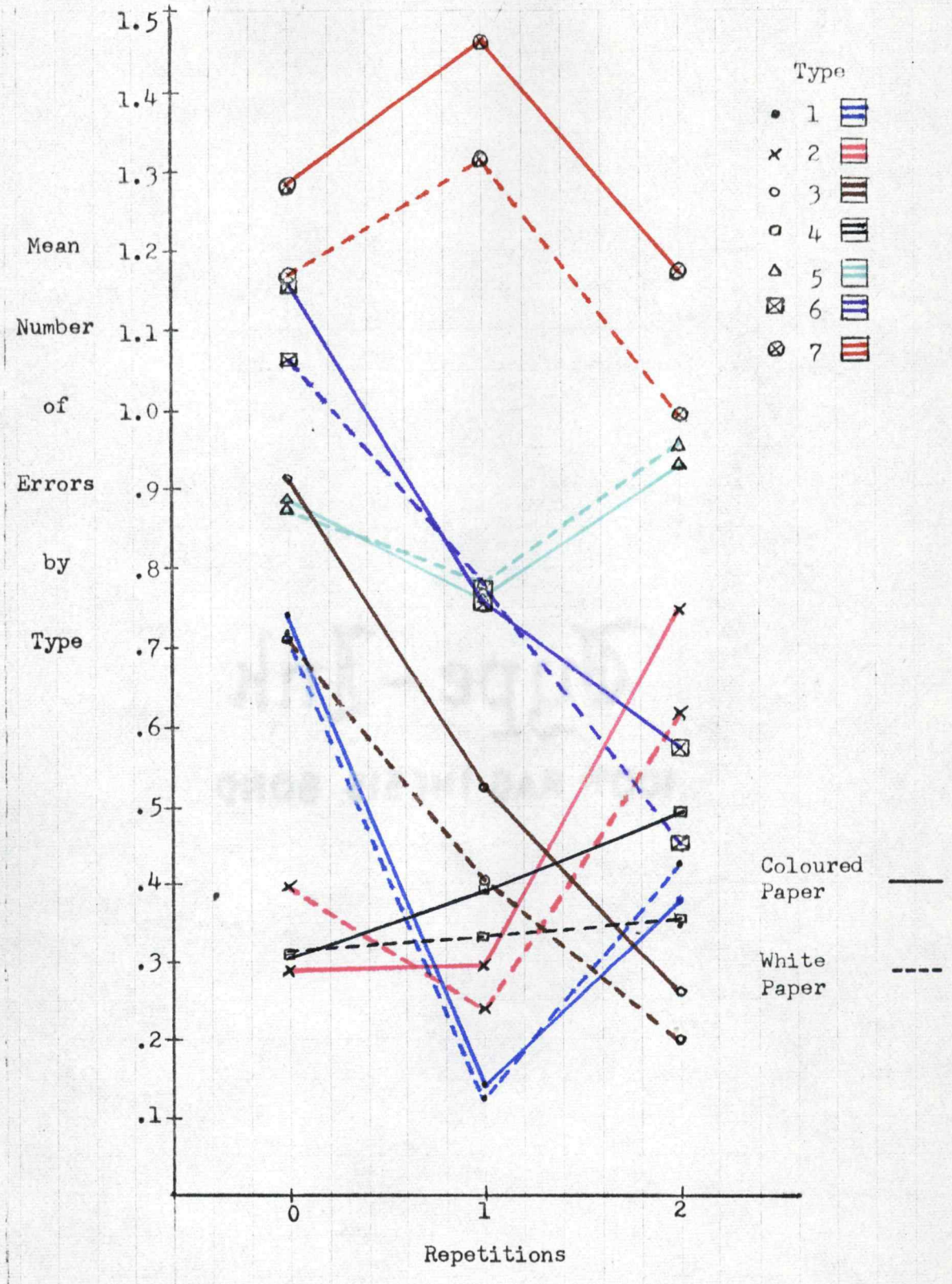


Figure 2. Mean Number Of Errors By Type As A Function Of The Number Of Repetitions

that the three types of errors that are most difficult to detect are those where the form of the word is substantially correct in structure and content which enables the proofreader to follow the context of a sentence without interruption, while the last four are spelling errors where deformities in the words may be more obvious to a reader in search of errors.

The interaction effects which are of primary interest include those between:

1. The paper condition and types of errors is significant, $\underline{F}_{(6, 2040)} = 2.7793$, $p < .05$; which means that the rank order of difficulty for types of errors changes with the use of paper of different colours. The rank order for coloured paper is 7, 5, 6, 3, 2, 1, and 4, while for white paper 7, 5, 6, 3, 1, 2, and 4 respectively. It is seen that the rank order is fairly consistent, with only error types 1 and 4 reversed.

2. The factors of the treatment of repetition and types of errors is significant, $\underline{F}_{(12, 4080)} = 64.6662$, $p < .01$; which means that the rank order of inaccuracy of the seven error types changes with the frequency of repetition as shown below:

Repetitions	0	1	2
Error Type	7	7	7
	6	5	5
	3	6	2
	5	3	6
	1	4	4
	4	2	1
	2	1	3

Repetitions	0	1	2
	7	7	7
	6	6	5
	5	5	2
	1	3	6
	3	4	1
	2	2	4
	4	1	3

Error types 5, 6, and 7 are found in the upper half of the scale for both groups, but no meaningful pattern of consistency can be discerned.

3. The factors of the paper condition, number of repetitions, and types of errors is significant, $F_{(12, 4080)} = 1.9075$, $p < .05$; which means that any change made to any of these three variables will influence the effect shown by the other two. Hence the data obtained relating to these three variables would be applicable only as conceived in the present study.

Analysis of Data Concerning the Effect of the Location of Errors by Vertical Quartiles

Proofreading performance in terms of mean percentage of errors by vertical quartiles is shown in Table 9 and Figure 3.

Table 9. Mean percentage of errors by vertical quartiles for two independent groups

	Number of Repetitions	1	2	3	4	Mean
Coloured Paper	0	.380	.530	.307	.371	.397
(n = 171)	1	.319	.312	.200	.341	.293
	2	.473	.353	.253	.153	.307
	Mean	.391	.398	.253	.288	.333
White Paper	0	.377	.509	.243	.366	.374
(n = 171)	1	.298	.276	.175	.339	.272
	2	.415	.337	.197	.162	.278
	Mean	.363	.373	.205	.289	.308
	Mean of Means	.377	.386	.219	.289	.321

*Each quartile is numbered consecutively from the left side of the page.

An analysis of variance was performed on the data, which yielded the results shown in Appendix M.

The main effect derived from the paper condition is significant, $F_{(1,340)} = 4.6985$, $p < .05$; which means that on the average, when the white paper is used, the accuracy level of proofreading in terms of mean total percentage of errors by vertical quartiles, is higher than for the coloured paper.

Another main effect due to the factor of repetition is significant, $F_{(2,680)} = 90.2858$, $p < .01$; which means that in general, proofreading with 1 repetition results in the highest level of accuracy in terms of mean percentage of errors by vertical quartiles, closely followed

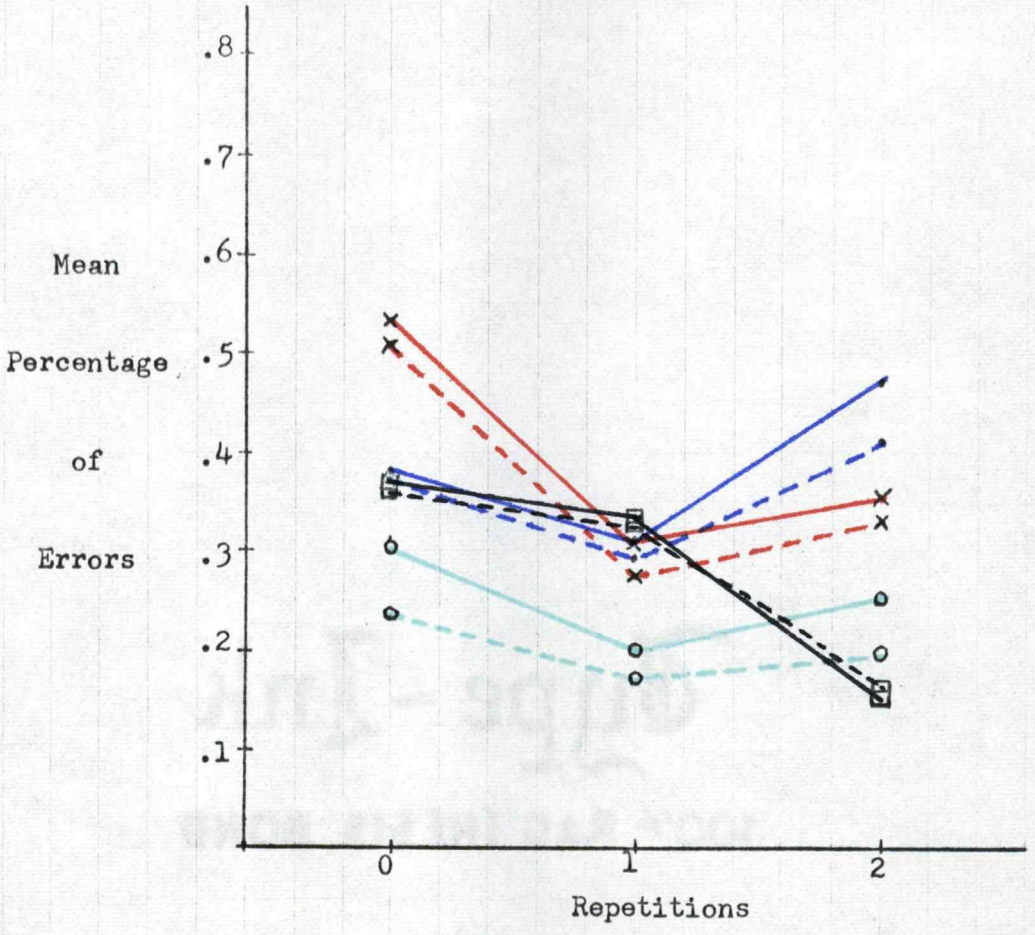


Figure 3. Mean Percentage Of Errors By Vertical Quartiles As A Function Of Repetition

Coloured Paper ——

White Paper ----

Quartile

• 1

× 2

o 3

□ 4

by two repetitions. Errors increase to a much higher level with 0 repetition.

Another main effect arises from the factor of location of errors in terms of vertical quartiles. This is significant and $\underline{F}_{(3, 1020)} = 134.7265$, $p < .01$; which means that on the basis of location by vertical quartiles, the rank order of difficulty in proofreading is 2, 1, 4, and 3 respectively. This is seen in both groups, and indicates that errors located on the left side of the page are more difficult to detect than those found on the right side.

The interaction effects which are of major interest include those between:

1. The paper condition and location by vertical quartiles factors is nonsignificant, $\underline{F}_{(3, 1020)} = 2.4431$, $p > .05$.

2. The factors of repetition and vertical quartile location is significant, $\underline{F}_{(6, 2040)} = 59.0150$, $p < .01$; which means that the rank order of inaccuracy in proofreading on the basis of location by vertical quartiles changes with the number of repetition for both groups as shown below:

Repetitions	0	1	2
Quartile	2	4	1
	1	1	2
	4	2	3
	3	3	4

3. The paper condition, repetition, and vertical quartile location factors is nonsignificant, $\underline{F}_{(6\ 2040)} = .8584$, $p > .05$.

Analysis of Data Concerning the Effect of the Location of Errors by Horizontal Quartiles

Proofreading performance in terms of mean percentage of errors by horizontal quartiles is shown in Table 10 and Figure 4.

Table 10. Mean percentage of errors by horizontal quartiles for two independent groups

	Number of Repetitions	Quartile* 1	2	3	4	Mean
Coloured Paper	0	.206	.300	.638	.357	.375
(n = 171)	1	.241	.156	.420	.409	.307
	2	.350	.273	.347	.330	.325
	Mean	.264	.249	.468	.365	.336
White Paper	0	.208	.303	.596	.321	.357
(n = 171)	1	.217	.158	.346	.402	.281
	2	.363	.214	.263	.314	.288
	Mean	.262	.225	.401	.346	.309
	Mean of Means	.263	.237	.435	.356	.323

*Each quartile is numbered consecutively from the top of the page.

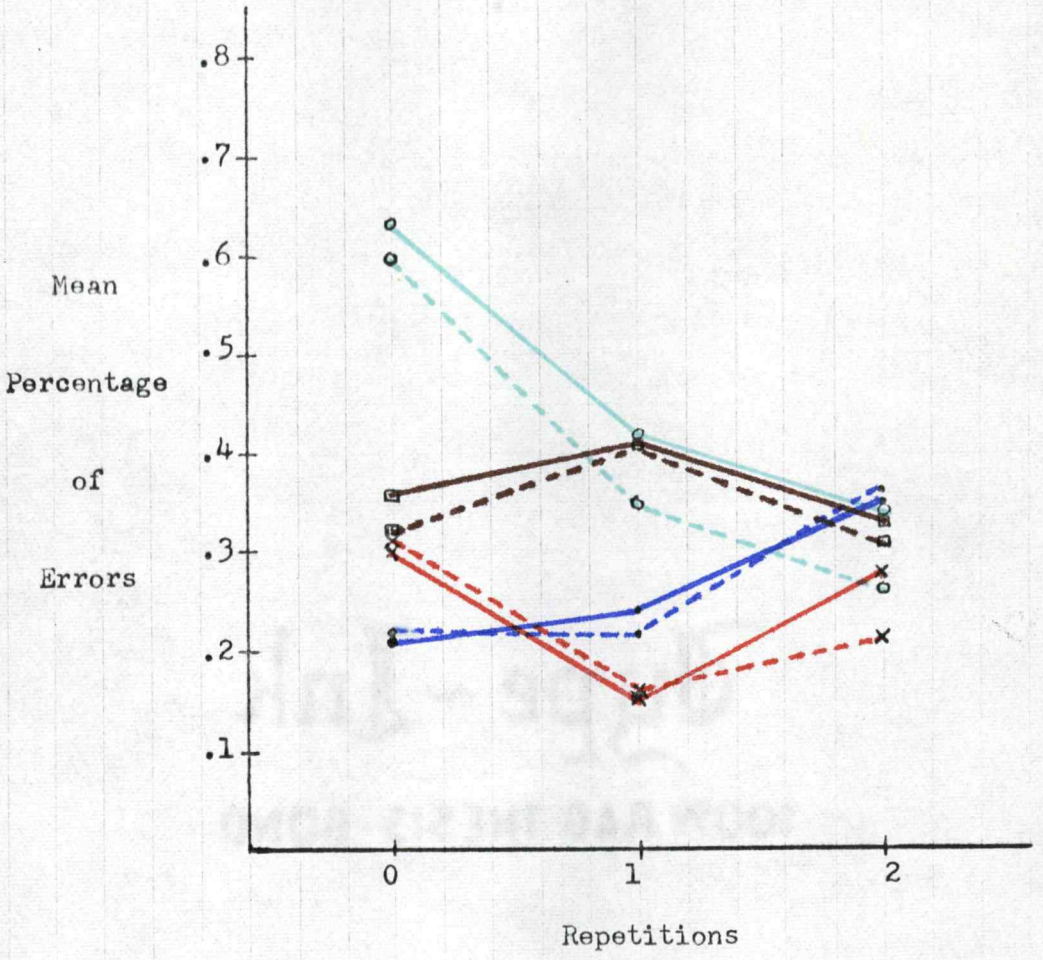


Figure 4. Mean Percentage Of Errors By Horizontal Quartiles As A Function Of Repetition

Coloured Paper ——

White Paper ----

Quartile

• 1

× 2

o 3

□ 4

The main effect due to paper condition is significant, $F_{(1, 340)} = 3.9463$, $p < .05$; which means that when the white paper is used, the accuracy level of proofreading in terms of mean percentage of total errors by horizontal quartiles, is higher than for the coloured paper.

The main effect due to the factor of repetition is significant, $F_{(2, 680)} = 41.7515$, $p < .01$; which means that on the average, 1 repetition results in the highest level of accuracy in terms of mean percentage of errors by horizontal quartiles, followed closely by 2 repetitions with the white paper, and at a greater differential with the coloured paper. The mean percentage of total errors rises to a much higher level with 0 repetition, as is easily seen in Table 10.

Another main effect due to the factor of the location of errors by horizontal quartiles is significant, $F_{(3, 1020)} = 205.5979$, $p < .01$; which means that the most accurate proofreading is done in horizontal quartile 2, followed by 1, 4, and 3 respectively. This indicates that errors located on the top half of the page are more easily detected than those found on the bottom half.

The interaction effects which are of primary interest include those between:

1. The paper condition and horizontal quartile location factors is significant, $F_{(3, 1020)} = 4.7212$, $p < .01$; which means that on the average, the use of the white paper increases the accuracy of

proofreading on the basis of mean percentage of errors by horizontal quartiles, over the coloured paper.

2. The repetition and horizontal quartile location factors is significant, $F_{(6, 2040)} = 89.3007$, $p < .01$; which means that the rank order of difficulty in proofreading on the basis of location by horizontal quartiles changes with both groups as shown below:

	Coloured Paper				White Paper		
Repetitions	0	1	2	Repetitions	0	1	2
	3	3	1		3	4	1
	4	4	3		4	3	4
	2	1	4		2	1	3
	1	2	2		1	2	2

No meaningful pattern is discernible.

3. The factors of the paper condition, repetition and location by horizontal quartiles is not significant, $F_{(6, 2040)} = 1.2624$, $p > .05$.

V. SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

An experimental study was conducted with beginning typewriting students to investigate the effects of two variables in proofreading straight copy paragraph materials in the independent method of proofreading. One was the influence of repetition which was examined through the use of three different methods of reading. The second was the effect of the use of paper of different colours as background context defined as illuminating, neutral, or unilluminating in terms of whether colour was an aid or hindrance to readability. A comparison of the level of inaccuracy in proofreading was made between seven types of errors. These include:

1. Doubling of small words or of syllables within a word
2. Omission of a letter within a word
3. Omission of one of a pair of doubled letters
4. Transposition of letters within a word
5. Spacing errors
6. Substitution of words
7. Transpositions of words

The influence of error location was investigated through an analysis of the mean percentage inaccuracy score by vertical and horizontal quartiles.

Method

Two independent groups composed of 172 and 171 subjects were randomly selected from beginning typewriting classes in two urban school districts. Each group wrote three criterion tests in which 14 errors (2 each of 7 error types selected) were loaded. One group wrote tests printed on white paper, defined as neutral, while the other completed tests printed on paper of colours defined as illuminating, unilluminating, and neutral respectively. These tests were equivalent in readability level and error load to each other, and to the materials used in beginning typewriting classes. The effect of repetition was investigated by asking subjects to proofread with 0, 1, and 2 repetitions on three tests that were administered on three successive days. Performance was measured in terms of time, total errors, number of errors by type, and the mean percentage of errors by location. The significance of the differences between means was determined through an analysis of variance and F tests at the one and five percent levels.

Findings

1. Colour does not affect the proofreading time rate. The use of white or neutral paper produces a higher accuracy level in proofreading over coloured paper in terms of total errors, mean errors

by type, and mean percentage of errors by vertical and horizontal location.

2. The proofreading rate recorded in relation to the frequency of repetition in reading was 1.03 minutes per 100 words for 0 repetition, 1.05 minutes for 1 repetition, and 1.33 minutes for 2 repetitions. One repetition yielded the highest level of accuracy in terms of total errors, error type, and vertical and horizontal location of errors.

3. The inaccuracy level recorded in terms of mean total errors was 39%, 30%, and 31% for 0, 1, and 2 repetitions respectively, indicating that a single reading is insufficient and a third reading does not assist a reader in finding errors that were undetected with 1 repetition.

4. The rank order of inaccuracy of the seven types of errors are: 1. transposition of words within a sentence 2. spacing errors - omission and extra spaces 3. substitution of one small word for another 4. omission of one of a pair of doubled letters 5. omission of a letter within a word 6. doubling of small words or of syllables within a word 7. transpositions of letters within a word.

5. Errors located on the left half of the page and on the bottom half of the page are more difficult to detect.

Conclusions

1. The differential shown in the time measure indicates that repeated readings of a given passage require a very small proportion of additional time after the first reading has been completed.

2. One repetition of reading yields the highest level of accuracy in terms of total errors, error type, and vertical and horizontal location of errors. The differential between means for 1 and 2 repetitions for total errors is .14, which is virtually identical. No advantage is gained by the second repetition. The data indicate that a single reading (0 repetition) for typographical errors is insufficient as inaccuracy scores are significantly higher than for the other two frequencies.

3. The use of colour as background context in printed materials does not affect the reading time. The time factor, however, is influenced by the number of repetitions. Although an increase in the frequency of repetitions necessitates a progressively longer time interval for reading, the differential between means is only .07 minute (4 seconds) between 0 and 1 repetition, and .82 minute (49 seconds) between 1 and 2 repetitions. The mean reading time recorded per 100 words was 1.05 - 1.33 minutes, but the range recorded was .33 to 3 minutes. To allow for the range of reading ability found in a

class, the data suggest that 3 minutes of reading time be provided per 100 words of copy.

4. The data indicate that the use of white paper facilitates accurate proofreading over coloured paper. The mean total number of errors is significantly lower for the former.

5. Proofreading copy twice (1 repetition) produces the highest level of accuracy as compared with frequencies of 0 and 2 repetitions. The data suggest that a single reading is insufficient while a second repetition (third reading) does not assist the reader in finding the errors missed on previous readings.

The inaccuracy levels recorded ranged from means of 30 - 39 percent for the two groups with a mean of means of 33 percent. These levels are lower than the findings reported in the Ewart survey where the average errors per person in the junior high school group is 15.9 out of a total of 38 errors which is calculated to be 42 percent. Nevertheless the level of inaccuracy of the magnitude recorded in this study confirms the conclusions published in other studies that the task of accurate proofreading is much more difficult than educators assume.

6. The rank order of inaccuracy for the seven types of errors used in the study is:

1. Transposition of words within a sentence

2. Spacing errors

3. Substitution of one small word for another

4. Omission of one of a pair of doubled letters

5. Omission of a letter within a word

6. Doubling of small words or of syllables within a word

7. Transpositions of letters within a word.

The data show that the first three error types were missed approximately twice as frequently as the remaining four.

7. The analysis of data on error types suggests that mistakes that are substantially correct in structure and content are more difficult to detect than those containing spelling deformities. The three error types that were missed most frequently are flaws that confirm the description of the process of reading in terms of physiological and perceptual factors as the "testing of hypotheses." During a fixation pause, the visual system is interpreting and integrating the stimuli correctly and is ready to continue. The three aforementioned error types enable the reader to follow the context of a sentence without interruption, hence the proofreader's need for comprehension is satisfied and he is misled into thinking that he is able to continue. The deformities found in the remaining four error types would probably cause the reader to be aware that some deviation from the normal situation was present, and hence he would stop to determine the cause of the deviation and thus detect the error.

8. Although the rank order of difficulty changes in terms of frequency or repetition, the data do not indicate that certain types of errors usually are found in the course of re-reading, or that the factor of familiarity with subject content aids in error detection.

9. The data on locational factors indicate that errors found on the left side and on the bottom half of the page are more difficult to detect.

Recommendations

The subject of proofreading is virtually unexplored territory as far as research is concerned in Business Education. Additional information is needed to increase our knowledge about all the variables that determine proofreading efficiency or disability. Although the need for proofreading spans all subject areas, these recommendations pertain to the field of typewriting.

1. The data substantiate the findings of other studies that almost all students are not proofreading accurately. Hence it is necessary that business teachers gain awareness of this situation and wider publicity be disseminated about this problem. Teachers who expect students to proofread accurately should realize that consistent proofreading proficiency is not prevalent.

2. The data obtained from the present study suggest that three minutes of proofreading time be provided to students for each 100

words of copy, to allow for the range of reading ability found within a class.

3. One repetition is recommended when students are proofreading for typographical errors in the independent method of proofing since this produces a significantly higher level of accuracy. If students are asked to re-read for thought content, and again for setup or organization, this implies that a total of four readings is required.

4. The use of white paper is advocated over coloured paper since error detection is facilitated by the former.

5. Students should be forewarned that the errors most difficult to find are those that are substantially correct in structure and content. The search for spelling flaws alone is insufficient.

6. Students should be aware that errors most frequently missed are located on the left side and the bottom half of the page.

7. To improve the students' proofreading ability, some form of systematic instruction should be integrated into the typewriting courses. Research is needed so that suitable methods and techniques can be developed and tested. The materials produced for the improvement of proofreading skills in the language arts area could be utilized as a starting point.

8. The interest and motivation for accuracy are unlikely to be widespread until proofreading ability is integrated into the body of skills and knowledge for which grades are given. It is recommended

that a greater value be assigned to the ancillary skills and knowledge (of which proofreading is only one part) concomitant to typewriting when student performance is being evaluated for grading purposes. Concurrently the speed rates which presently constitute the chief determinant of a student's grade should be assigned a lower value.

9. In view of the limited amount of verified knowledge about proofreading, much additional research is needed. Basic to the problem is the determination of the variables that comprise proofreading proficiency or disability.

10. Another area for investigation could be the development of a nomenclature and classification system for the identification of proofreading error types or categories. A standardized list used in a wide geographical area would assist in the comparison of findings reported in future studies.

BIBLIOGRAPHY

1. Ashley, R. Spotting teacher's mistakes keep pupils on their toes. Grade Teacher 84:24. 1966.

2. Berg, J. and C. J. Polyot. Influence of color on reactions to incomplete figures. Journal of Consulting Psychology 20:1-15. 1956.

3. Bills, R. E. and F. E. Harris. Psychological considerations of color selection. American School and University, 1953, p. 157-160.

4. Birren, Faber. Color, psychology and color therapy. New York, McGraw-Hill, 1961. 128 p.

5. _____ Principles of color. New York, Van Nostrand-Reinhold, 1969. 95 p.

6. _____ Psychology of color for the schoolroom. Nation's School 57:92-94. 1956.

7. Blackstone, Earl G. and Sofrona L. Smith. Improvement of instruction in typewriting. 2d ed. New York, Prentice-Hall, 1949. 470 p.

8. Bond, Guy G. and Miles A. Tinker. Reading difficulties: their diagnosis and correction. 2d ed. New York, Appleton-Century-Crofts, 1967. 564 p.

9. Brendel, L. A. Integrate your spelling, punctuation, and proofreading program. Part I. Business Education World 37: 15-17. 1957.

10. _____ Integrate your spelling, punctuation, and proofreading program. Part II. Business Education World 37:33-35. 1957.

11. _____ Pinpointing critical areas of proofreading. Part I. Business Education World 47:17-18, 32. 1966.

12. _____ Pinpointing critical areas of proofreading. Part II. Business Education World 47:14, 20. 1966.

13. _____ Yes they proofread, if--. Part I. Journal of Business Education 29:241-243, 255. 1954.

14. _____ Yes they proofread, if--. Part II. Journal of Business Education 29:295-297. 1954.

15. British Columbia. Superintendent of Education. Public schools of the province of British Columbia 1968/69. Victoria, B. C. Queen's Printer, 1970. 199 p.

16. Carmichael, Leonard and W. F. Dearborn. Reading and visual fatigue. Cambridge, Houghton Mifflin, 1947. 483 p.

17. Chall, Jeanne S. Readability--an appraisal of research and application. Columbus, Ohio State University, 1958. 202 p.

18. Child, I. L. et al. Age and sex differences in children's color preferences. Child Development 39:237-247. 1968.

19. Cleary, J. B. Let's teach proofreading. Balance Sheet 36: 14-15. 1954.

20. Clem, Jane E. Techniques of teaching typewriting. 2d ed. New York, McGraw-Hill, Gregg Division, 1955. 380 p.

21. Coard, R. L. Proofread, proofread, proofread. Journal of Business Education 33:20-22. 1957.

22. Crawford, James. Typewriting and the vocational education act. Part I. Business Education Forum 18:18. 1964.

23. _____ Typewriting and the vocational education act. Part II. Business Education Forum 18:24. 1964.

24. Crosland, Harold R. An investigation of proofreader's illusion. Eugene, 1924. 168 p. (University of Oregon Publications. Vol. 2, no. 6)

25. DeBoer, John J. Composition, handwriting, and spelling. Review of Educational Research 31:161-172. 1961.

26. Diack, Hunter. Reading and the psychology of perception. Nottingham, Peter Skinner, 1960. 155 p.

27. English, M. D. Use of color in instructional materials. Educational Leadership 16:455. 1959.

28. Ettlinger, George. Visual alexia. In: Models for the perception of speech and visual forms: Proceedings of a symposium. Cambridge, MIT, 1964. p. 185-186.

29. Evans, Ralph M. Variables of perceived color. Journal of the Optical Society of America 54:1467-1474. 1964.

30. Ewart, Margaret J. Unpublished study to determine the types of straight copy proofreading errors made by typewriting students at various levels plus selected groups of business teachers and executive secretaries. Corvallis, Oregon State University, Dept. of Business Education, 1963. 48 numb. leaves.

31. Flynn, Marjorie A. Analysis and comparison of the errors of a one-year typewriting group and the errors of a three-year typewriting group in typing selected timed writing tests. National Business Education Quarterly 28(1):20, 1959.

32. Forkner, Hamden. What I wished I had learned about typewriting. Business Education Forum 13:7-9. 1958.

33. Foster, William R. Can we avoid proofreader's illusions? Business Education World 18:705-707. 1938.

34. _____ Shall we carelessly say it's carelessness? Part I. Business Education World 18:451-453. 1938.

35. _____ Shall we carelessly say it's carelessness? Part II. Business Education World 18:557-558. 1938.

36. _____ Test for error-checking ability. Business Education World 18:807-808. 1938.

37. _____ Why don't our pupils check all their typing errors? Business Education World 30:383-384. 1950.

38. Frasch, D. K. How well do sixth-graders proofread for spelling errors? Elementary School Journal 65:381-385. 1965.

39. Garvey, C. Make proofreading exciting with the world's worst transcript. Business Education World 28:348-349. 1948.

40. Gates, Arthur I. The psychology of reading and spelling. New York, Columbia University, Teachers College, 1922. 108 p.

41. Gaw, G. D. Colors as an aid in reading. In: 11th yearbook of the Claremont, Calif., Claremont College, 1946. p. 99-105.

42. Genest, Marc. A study on typing errors. (Abstract) Psychological Abstracts 33:224. 1959.

43. Goins, Jean Turner. Visual perceptual abilities and early reading progress. Chicago, 1958. 109 p. (University of Chicago. Supplementary Education Monographs No. 87)

44. Goss, James. Analysis of accuracy of spelling in written compositions of elementary school children and the effects of proofreading emphasis upon accuracy. Doctoral dissertation. Norman, University of Oklahoma, 1959. 107 numb. leaves. (Microfilm)

45. Green, H. H. Use your duplicated school papers for some lessons in proofreading. Business Education World 32:242-244. 1952.

46. Gregg, John Robert. Applied secretarial practice. 5th ed. New York, Gregg, 1962. 499 p.

47. Gregory, Richard Langton. Eye and brain: the psychology of seeing. New York, McGraw-Hill, 1966. 254 p.

48. Grubbs, Robert L. To circle or not to circle. Business Teacher, Mar.-Apr., 1967, p. 8-9.

49. Guilford, J. P. Fundamental statistics in psychology and education. New York, McGraw-Hill, 1956. 565 p.

50. Haber, Ralph Norman. Repetition in perceptual recognition processes. In: Models for the perception of speech and visual forms: Proceedings of a symposium. Cambridge, MIT, 1964. p. 202-211.

51. Hanna, G. Proofreading, a panacea: attention junior high English teachers. English Journal 51:482-483. 1962.

52. Hawley, M. Proofreading pupil compositions. Instructor 72: 53-54. 1963.

53. Hellman, Hal. The art and science of color. New York, McGraw-Hill, 1967. 175 p.

54. Henning, V. C. A lesson on proofreading. United Business Education Forum 5:28-29. 1950.

55. Heron, L. Do a better job in an easier way. Journal of Business Education 40:63-66. 1964.

56. Hopkins, G. Using the overhead projector to teach proofreading. Industrial Arts and Vocational Education 53:24. 1964.

57. Horn, Ernest. Spelling. In: Encyclopaedia of Educational Research. 3rd ed. New York, MacMillan, 1960. p. 1337-1350.

58. Huey, Edmund Burke. The psychology and pedagogy of reading. New York, MacMillan, 1916. 469 p.

59. Hutchinson, Lois Irene. Standard handbook for secretaries. 7th ed. New York, McGraw-Hill, 1966. 638 p.

60. Jester, Don. We can improve transcription by learning how the transcriber's time is split up. Business Education World 42:12-15. 1962.

61. Johnson, Lois J. Proofreading; a student responsibility. English Journal 56:1323-1324. 1967.

62. Johnson, Roland. Proofreading practice who needs it? Business Teacher, Jan.-Feb., 1966, p. 14.

63. Jones, J. K. Colour as an aid to visual perception in early reading. British Journal of Educational Psychology 35:21-27. 1965.

64. Kagan, J. and J. Lemkin. Form, color and size in children's conceptual behavior. Child Development 32:25-28. 1961.

65. Ketchum, Howard. Color planning for business and industry. New York, Harper, 1958. 274 p.

66. Kittross, J. M. Some attempts to develop an index of interest. Journal of Communication 12:225-233. 1962.

67. Lamb, Marion M. Your first year of teaching typewriting. 2d ed. Cincinnati, Southwestern, 1959. 290 p.

68. Lasky, Burton. Proofreaders need periodic reviews. Inland and American Printer and Lithographer 146(3):73. 1960.

69. _____ Urges improvement in training methods. Inland and American Printer and Lithographer 146(5):67, 124. 1961.

70. Lloyd, Alan C. Let's make proofreading affirmative. Business Education World 30:335-337. 1950.

71. Luckiesh, Matthew. Light and color in advertising and merchandising. New York, Van Nostrand, 1927. 268 p.

72. _____ Visual illusions their causes, characteristics and applications. New York, Dover, 1965. 252 p.

73. Luckiesh, Matthew and Frank K. Moss. Reading as a visual task. New York, Van Nostrand, 1942. 429 p.

74. McKillop, Anne Selby. The relationship between the reader's attitude and certain types of reading response. New York, Columbia University, Teachers College, 1952. 101 p.

75. McKowen, C. Proofreading for spelling errors. English Journal 52:530. 1963.

76. Marquard, Richard L. Interrelationship among the senses and the reading process. In: 30th yearbook of the Claremont Reading Conference. Claremont College, 1965. p. 141-145.

77. Moodie, A. G. Coordinator of Research Studies and Testing, Vancouver School Board. Personal communication. Vancouver, B. C. April 2, 1970.

78. Mouly, George W. Science of educational research. New York, American Book, 1963. 515 p.

79. Nellermoe, Donald A. The location and frequency of typewriting errors on straight-copy material made by first-year typewriting students in grades nine through twelve inclusive during the tenth and seventeenth week of instruction. Master's thesis. Grand Forks, University of North Dakota, 1962. 105 numb. leaves. (Microfilm)

80. Nichols, Augusta M. The analysis and correction of spelling difficulties. Elementary School Journal 50:154-161. 1949.

81. O'Hara, Winifred. Typewriting plus reading? Business Teacher, Nov.-Dec., 1968, p. 4-5.

82. Parmenter, Ross. The awakened eye. Middletown, Wesleyan University, 1968. 352 p.

83. Personke, C. and L. Knight. Proofreading and spelling: a report and a program. Elementary English 44:768-774. 1967.

84. Peterson, J. C. and J. Staples. Declare war on undetected typing errors. Business Education World 49:9-10, 22-24. 1969.

85. Phillips, C. A. Importance of color in textbooks. Catholic School Journal 57:147-148. 1957.

86. Proofreaders screen letters. American Business 22(4):34-38. 1952.

87. Quinn, Hayes. Reading color. In: 13th yearbook of the Claremont College Reading Conference. Claremont, Calif., Claremont College, 1948. p. 147-157.

88. Raphael, Sister Mary. Color: a new dimension in teaching reading: words in color. Catholic School Journal 66:56-57. 1966.

89. Rea, Polly S. A study of two methods of teaching proofreading of straight copy timed writings. Master's thesis. Auburn, Auburn University, 1965. 32 numb. leaves.

90. Rice, A. H. What research knows about color in the classroom. Nation's School 52:I-VIII. 1953.

91. Robinson, E. K. Shorthand and typing papers can be corrected by machine. Journal of Business Education 42:130. 1966.

92. Rowe, J., A. Lloyd and F. Winger. Gregg typing 191 series. Canadian ed. Toronto, McGraw-Hill, 1965. 280 p.

93. Rowe, Margaret F. Do your students have blind spots? Business Education World 29:48-51. 1948.

94. Rowe, Margaret F. Proofreading is a skill too! Business Education World 29:113-114. 1948.

95. _____ Why's and the wherefore's. Business Education World 29:372-373. 1949.

96. Ruegg, Robert J. Typewriting standards in business. Business Education Forum 13:29-30. 1958.

97. Russon, Allien R. and S. J. Wanous. Philosophy and psychology of teaching typewriting. Cincinnati, Southwestern, 1960. 442 p.

98. Shearron, G. F. Color deficiency and reading achievement in primary school boys. Reading Teacher 22:510-512, 577. 1969.

99. Staley, J. J. et al. Color in discriminative learning by children. Journal of Experimental Education 31:325-326. 1963.

100. Staples, John D. An experimental study to identify the basic abilities needed to detect transcript errors with implications for the improvement of instruction in typewriting. Doctoral dissertation. Grand Forks, University of North Dakota, 1965. 203 numb. leaves. (Microfilm)

101. Teall, E. N. Proofreader's abilities defined. Inland Printer 100:74-75. 1937.

102. Toronto uses playback in proof and mss reading. Publisher's Weekly 177(22)46-47. 1960.

103. Vernon, M. D. Visual perception. Cambridge, Cambridge University, 1937. 247 p.

104. Wanous, S. J., B. Haggblade and W. B. Glenn. Personal typewriting. Canadian ed. Toronto, Gage, 1967. 242 p.

105. Watkins, G. V. Proofreading can be an adventure. Journal of Business Education 25:19-20. 1950.

106. Winger, Fred. Pretranscription training in typewriting. American Business Education, Oct. 15, 1958, p. 54-55.

107. Wittick, Mildred Letton. Correctness and freshness--can children's writing have both? Elementary School Journal 54: 295-300. 1960.

108. Worden, Jack D. Visual considerations in learning performance. In: 31st yearbook of the Claremont Reading Conference. Claremont, Calif., Claremont College, 1966. p. 175-178.

109. Wright, W. D. The rays are not coloured. London, Adam Hilger, 1967. 154 p.

110. Yingst, Ned E. Teaching proofreading and error analysis. Typing News 34:7. 1964.

111. Young, Dorothy Ann. Proofreading--do you teach or tolerate it? Typing News, Fall, 1968, p. 4, 6.

APPENDICES

APPENDIX A. SECONDARY SCHOOLS IN BURNABY AND VANCOUVER COMPRISING THE POPULATION PARAMETER IN ALPHABETICAL ORDER

Burnaby	Vancouver
Alpha	Britannia
Burnaby Heights	Lord Byng
Cariboo Hill	Sir Winston Churchill
Edmonds	Gladstone
Kensington	Eric Hamber
McPherson Park	John Oliver
Moscrop	Killarney
Royal Oak	King George
	Kitsilano
	Magee
	Point Grey
	Prince of Wales
	Vancouver Technical
	Templeton
	David Thompson
	Sir Charles Tupper
	Windermere

APPENDIX B. CLASSES SELECTED FOR SAMPLE ARRANGED ALPHABETICALLY BY TEACHER AND SCHOOLS IN THE ORDER OF APPEARANCE IN RANDOM SAMPLING FOR BURNABY

BURNABY

1. McPherson Park

Teacher	Class Block	Number Assigned
Harold	B	1
	C	2
	E	3
	F	4
Neuman	B	5
	D	6
	F	7
Wong	A	8
	C	9
	H	10

Classes selected randomly: 1, 8

2. Cariboo Hill

Teacher	Class Block	Number Assigned
Bloom	A	1
	B	2
Lynes	C	3
	F	4

Classes selected randomly: 2, 3

3. Edmonds

Teacher	Class Block	Number Assigned
Clark	C	1
	D	2
	E	3
	F	4
Crute	A	5
Lang	C	6
	F	7
	G	8
	H	9

Classes selected randomly: 5, 8

4. Moscrop

Teacher	Class Block	Number Assigned
Dillon	D	1
	E	2
	F	3
	H	4
Halpin	B	5
	C	6
Hodges	A	7
	E	8
	F	9
	G	10

Classes selected randomly: 5, 8

APPENDIX C. CLASSES SELECTED FOR SAMPLE ARRANGED ALPHABETICALLY BY TEACHER AND SCHOOLS IN THE ORDER OF APPEARANCE IN RANDOM SAMPLING FOR VANCOUVER

1. Eric Hamber

Teacher	Class Block	Number Assigned
Hinds	A	1
	C	2
MacPherson	D	3
Toolson	D	4

Classes selected randomly: 1, 3

2. Sir Winston Churchill

Teacher	Class Block	Number Assigned
Dunlop	C	1
	F	2
	G	3
Locke	A	4
Shoemaker	B	5
	D	6
	E	7
Tamm	A	8
	H	9

Classes selected randomly: 1, 8

3. Lord Byng

Teacher	Class Block	Number Assigned
Dennis	E	1
Harris	F	2
	G	3
Large	A	4
	B	5
	C	6

Classes selected randomly: 1, 6

4. Killarney

Teacher	Class Block	Number Assigned
Bartle	C	1
	D	2
Joslin	F	3
McCurrack	B	4
	E	5
	G	6
Weedrick	A	7
	D	8

Classes selected randomly: 3, 7

1. The reading ease score is not good below grade 5.

2. Size of sample - If item is short or you wish to be exact, test all material, generally for a book, 25-30 samples.

3. Picking a sample - Make a random selection, avoid introductory paragraph of chapter, use 100 word sampling, start sampling at beginning of the paragraph.

4. Count each word in sample - Do not count heads, count as words: all letters, numbers, symbols, groups that are surrounded by white space, hyphenations, and contractions.

5. For 100 word samples

   A. Count as a sentence if 100 word point falls after the middle of the sentence.
   B. In counting sentences, count as a sentence each unit of thought that is grammatically independent of another sentence or clause, if its end is marked by a period, question mark, exclamation point, semi-colon or colon.
   C. Count incomplete sentence or sentence fragments as complete sentences.
   D. Speech tags are part of the quoted sentence.

6. Figure average sentence length. If more than 1 sample, add the number of sentences in all samples and divide by the number of samples.

7. Figure average word length in syllables. Count all syllables and divide the total number of syllables by the total number of words, that is in general terms. In the formula, this part of the measure is expressed as the number of syllables per 100 words, therefore multiply your result by 100. If you use 100 word samples, count the total of all syllables in all samples and divide by the number of samples. Count the syllables the way you pronounce the word. Count the number of syllables in symbols and figures according to the way they are normally read aloud. If the passage contains many figures, leave them out in the syllable count.

8. To find the reading ease score

   A. Multiply average sentence length by 1.015
   B. Multiply average number of syllables per 100 words by .846
   C. Add the two above steps
   D. Subtract the sum attained in step C from 206.835

9. The scores may vary from 0 to 100.

10. To interpret score

    90 to 100 - 5th grade level
    80 to 90 - 6th grade level
    70 to 80 - 7th grade level
    60 to 70 - 8th and 9th grade level
    50 to 60 - 10th through 12th
    30 to 50 - 13th through 16th
    0 to 30 - college grad

    Around zero is practically unreadable

APPENDIX D. ANALYSIS OF PERSONAL TYPEWRITING USING FLESCH FORMULA*

Sample No.	1	2	3	4	5	6	7
Page	15	26	35	45	54	63	75
From	He	Hit	Grace	Highway	It	You	Dear
To	have	jnj	a	human	very	treatment	my
Sentences	18	9	11	13	8	9	8
Syllables	100	100	116	155	114	110	128

Sample No.	8	9	10	11	12	13
Page	85	94	105	117	125	133
From	849	Benjamin	Taking	Marvel	Do	Edison
To	very	It	Don't	Weaver	team	way
Sentences	12	7	11	10	8	10
Syllables	156	127	118	161	124	129

Sample No.	14	15	16	17	18	19	20
Page	144	156	165	176	187	195	206
From	2759	Looking	Mr.	1.	When	Every	Do
To	caught	blanks	lost	to	of	make	poem
Sentences	12	7	9	9	6	5	5
Syllables	163	133	141	167	142	131	128

Sample No.	21	22	23	24
Page	214	223	234	242
From	When	Somebody	To	While
To	on	bounce	fail	You
Sentences	8	5	7	6
Syllables	135	135	155	129

Average sentence length $= \frac{213}{24} = 8.875 = \frac{100}{8.875} = 11.261$

Average syllable count $= \frac{3197}{24} = 133.21$

Average sentence length x 1.015 = 11.261 x 1.015 = 11.4299

Average syllable count x .846 = 133.21 x .846 = 112.6957

Total = 124.1256

Constant - Total = 206.835 - 124.126 = 82.709

Reading level: 6th grade

*1 sample taken approximately every 10 pages

APPENDIX E. ANALYSIS OF BUILDING TYPING SKILLS USING FLESCH FORMULA*

Sample No.	1	2	3	4	5	6	7
Page	15	25	35	43	57	62	72
From	A	"Come	1. What	Five	What	Winter	How
To	six	book,	azure	letter	show	fast	begin
Sentences	6	6	11	5	8	7	8
Syllables	120	135	140	127	125	132	140

Sample No.	8	9	10	11	12
Page	85	95	105	115	126
From	Miss	One	Much	This	Nature
To	hiring	benefit	penmanship	closing	as
Sentences	5	7	5	7	7
Syllables	172	154	136	157	145

Sample No.	13	14	15	16
Page	135	145	156	165
From	Twice	1. Do	Canada	All
To	rarest	bodies	at	in
Sentences	5	5	6	9
Syllables	125	175	169	137

Sample No.	13	14	15	16
Page	135	145	156	165
From	Twice	1. Do	Canada	All
To	rarest	bodies	at	in
Sentences	5	5	6	9
Syllables	125	175	169	137

Average sentence length = $\frac{107}{16}$ = 6.6875 = $\frac{100}{6.6875}$ = 14.9521

Average syllable count = $\frac{2289}{16}$ = 143.0625.

Average sentence length x 1.015 = 14.9521 x 1.015 = 15.1763

Average syllable count x .846 = 143.0625 x .846 = 121.0309

Total = 136.2072

Constant - Total = 206.835 - 136.207 = 70.628

Reading level: 7th grade

*1 sample taken approximately every 10 pages

APPENDIX F. ANALYSIS OF TYPEWRITING DRILLS FOR SPEED AND ACCURACY USING FLESCH FORMULA*

Sample No.	1	2	3	4	5	6	7
Page	4	10	17	20	24	30	34
From	Years	Certain	The	Keep	After	A	Mail
To	few	assure	work	forward	firms	if	then
Sentences	5	7	7	5	5	3	5
Syllables	138	159	134	145	146	178	132

Sample No.	8	9	10	11	12	13
Page	40	44	50	54	60	64
From	Use	A	Be	Be	Optional	Observe
To	grades	Next,	and	lines	office	contents
Sentences	7	6	5	6	4	7
Syllables	174	128	135	137	160	129

Sample No.	14	15	16	17	18
Page	70	74	80	84	90
From	Welcome	One	2. If	Our	Lots
To	have	able	the	the	change
Sentences	6	6	6	3	5
Syllables	143	119	151	129	154

Average sentence length = $\frac{98}{18}$ = 5.444 = $\frac{100}{5.444}$ = 18.3688

Average syllable count = $\frac{2591}{18}$ = 143.9444

Average sentence length x 1.015 = 18.3688 x 1.015 = 18.6443

Average syllable count x .846 = 143.9444 x .846 = 121.7770

Total = 140.4213

Constant - Total = 206.835 - 140.421 = 66.414

Reading level: 8th grade

*1 sample taken approximately every 5 pages

APPENDIX G. ERROR LOAD BY QUARTILES

Vertical

Test	Quartile 1	2	3	4
1	5	3	3	3
2	5	3	2	4
3	5	2	4	3

Horizontal

Test	Quartile 1	2	3	4
1	2	5	4	3
2	4	3	3	4
3	3	4	3	4

TEST 1 - WORD COUNT

Do you remember your first lesson in typing? From that /10 first period you began to learn about correct posture. No /20 matter what your level of skill, whether you type ten /30 or fifty words a minute, posture is a major factor /40 that will determine whether you will be a poor, average, /50 or excellent typist. Why is posture vital to your typing /60 progress?

Typing is described as a motor skill. If you /70 can type by touch, this means that when your eyes /80 perceive or look at a word, your fingers will instinctively /90 move to the right keys. Your brain will not make /100 a conscious effort to direct your fingers towards the keys /110 you need to hit to type the word. Thus touch /120 typing, like any other motor habit, involves automatic responses of /130 your body after the habit has been learned.

These are /140 the reasons why posture is important. The way you sit /150 and hold your arms determines how well you can move /160 your fingers. When you sit with your back against the /170 chair, your arms, wrists, and hands are pulled out of /180 proper position. Then your fingers cannot stroke at a quick /190 pace. Feet that do not lie flat on the floor /200 cause uneven left margins in your work. Your hands tend /210 to move too much if your wrists are not level. /220 Posture faults can cause excessive fatigue because the muscles are /230 strained.

An expert claims that 90% of our typing errors /240 can be blamed on poor posture habits. These bad habits /250 are very hard to change. Once a habit is acquired, /260 our body responds in the same way until a new habit /270 replaces it. Therefore the errors caused by poor posture /280 keep repeating themselves on your work. All typists must always /290 keep alert. Safeguard your good posture techniques at all times. /300

Total Words: 300

TEST 1 - SENTENCE LENGTH

Do you remember your first lesson in typing?/1 From that first period you began to learn about correct posture./2 No matter what your level of skill, whether you type ten or fifty words a minute, posture is a major factor that will determine whether you will be a poor, average, or excellent typist./3 Why is posture vital to your typing progress?/4

Typing is described as a motor skill./5 If you can type by touch, this means that when your eyes perceive or look at a word, your fingers will instinctively move to the right keys./6 Your brain will not make a conscious effort to direct your fingers towards the keys you need to hit to type the word./7 Thus touch typing, like any other motor habit, involves automatic responses of your body after the habit has been learned./8

These are the reasons why posture is important./9 The way you sit and hold your arms determines how well you can move your fingers./10 When you sit with your back against the chair, your arms, wrists, and hands are pulled out of proper position./11 Then your fingers cannot stroke at a quick pace./12 Feet that do not lie flat on the floor cause uneven left margins in your work./13 Your hands tend to move too much if your wrists are not level./14 Posture faults can cause excessive fatigue because the muscles are strained./15

An expert claims that 90% of our typing errors can be blamed on poor posture habits./16 These bad habits are very hard to change./17 Once a habit is acquired, our body responds in the same way until a new habit replaces it./18 Therefore the errors caused by poor posture keep repeating themselves on your work./19 All typists must always keep alert./20 Safeguard your own posture techniques at all times./21

Average number of sentences per 100 words = $\frac{21 \times 100}{30} = 7.00$

Average sentence length per 100 words = $\frac{100}{7} = 14.2857$

Test 1 - Syllable Count

Do you remember your first lesson in/10 typing? From that first period you/20 began to learn about correct posture. No/30 matter what your level of skill, whether/40 you type ten or fifty words a minute,/50 posture is a major factor that will/60 determine whether you will be a poor,/70 average, or excellent typist. Why/80 is posture vital to your typing progress?/90

Typing is described as a motor skill./100 If you can type by touch, this means that when/110 your eyes perceive or look at a word, your/120 fingers will instinctively move to the/130 right keys. Your brain will not make a conscious/140 effort to direct your fingers towards/150 the keys you need to hit to type the word./160 Thus touch typing, like any other motor habit,/170 involves automatic responses of your/180 body after the habit has been learned./190

These are the reasons why posture is important./200 The way you sit and hold your arms/210 determines how well you can move your fingers./220 When you sit with your back against the/230 chair, your arms, wrists, and hands are pulled out of/240 proper position. Then your fingers cannot/250 stroke at a quick pace. Feet that do not/260 lie flat on the floor cause uneven left/270 margins in your work. Your hands tend to move/280 too much if your wrists are not level. Posture/290 faults can cause excessive fatigue because/300 the muscles are strained.

An expert claims/310 that 90% of our typing errors/320 can be blamed on poor posture habits. These/330 bad habits are very hard to change. Once a/340 habit is acquired, our body responds/350 in the same way until a new habit/360 replaces it. Therefore the errors caused by/370 poor posture keep repeating themselves on/380 your work. All typists must always keep/390 alert. Safeguard your good posture techniques at/400 all times.

Average number of syllables per 100 words = $\frac{411 \times 100}{300} = 137.00$

Test 2- Word Count

If you bring up the subject of economics most people/10 will think about a course that they didn't study in/20 school. They didn't take it because they heard that it/30 was difficult. Others will tell you that they considered it/40 unimportant. This is a pity because we meet and deal/50 with economic problems every day of our lives.

Here is one/60 simple way in which we can think about economics./70 When we do not have enough to satisfy all our/80 needs, we must plan to use what is available in/90 the best way possible. In this manner we can get/100 the greatest satisfaction out of the resources we own. Let's/110 see how this applies in our daily living.

When your/120 father brings home his salary, there are all kinds of/130 things on which the money can be spent. The telephone/140 and light bills represent items which must be paid. Then/150 cash must be put aside for food. When all of/160 the expenses that must be paid have been taken care/170 of, then the family can decide how the extra money is/180 spent. Should the family save for a coloured television/190 set or for a new convertible car? Thus we are/200 faced with choices all the time.

Even when your mother/210 buys the groceries for the week she must make some/220 economic decisions. Thousands of products are found on the shelves/230 in the store. Out of these she selects what she/240 thinks is best for the family. Which product is the/250 best buy?

Better buying of course, is only one aspect/260 of economics. We all need to learn about this subject./270 Every day we are constantly faced with economic decisions that/280 we must make. We should have all the facts we/290 need so that we make a wise choice each time./300

Total Words: 300

Test 2 - Sentence Count

If you bring up the subject of economics most people will think about a course that they didn't study in school.[1] They didn't take it because they heard that it was difficult.[2] Others will tell you that they considered it unimportant.[3] This is a pity because we meet and deal with economic problems every day of our lives.[4]

Here is one simple way in which we can think about economics.[5] When we do not have enough to satisfy all our needs, we must plan to use what is available in the best way possible.[6] In this manner we can get the greatest satisfaction out of the resources we own.[7] Let's see how this applies in our daily living.[8]

When your father brings home his salary, there are all kinds of things on which the money can be spent.[9] The telephone and light bills represent items which must be paid.[10] Then cash must be put aside for food.[11] When all of the expenses that must be paid have been taken care of, then the family can decide how the extra money is spent.[12] Should the family save for a coloured television set or for a new convertible car ?[13] Thus we are faced with choices all the time.[14]

Even when your mother buys the groceries for the week she must make some economic decisions.[15] Thousands of products are found on the shelves in the store.[16] Out of these she selects what she thinks is best for the family.[17] Which product is the best buy ?[18]

Better buying of course, is only one aspect of economics.[19] We all need to learn about this subject.[20] Every day we are constantly faced with economic decisions that we must make.[21] We should have all the facts we need so that we make a wise choice each time.[22]

$$\text{Average number of sentences per 100 words} = \frac{22 \times 100}{300} = 7.333$$

$$\text{Average sentence length per 100 words} = \frac{100}{7.33} = 13.6426$$

Test 2 - Syllable Count

If you bring up the subject of economics most people will think about a course that they didn't study in school. They didn't take it because they heard that it was difficult. Others will tell you that they considered it unimportant. This is a pity because we meet and deal with economic problems every day of our lives.

Here is one simple way in which we can think about economics. When we do not have enough to satisfy all our needs, we must plan to use what is available in the best way possible. In this manner we can get the greatest satisfaction out of the resources we own. Let's see how this applies in our daily living.

When your father brings home his salary, there are all kinds of things on which the money can be spent. The telephone and light bills represent items which must be paid. Then cash must be put aside for food. When all of the expenses that must be paid have been taken care of, then the family can decide how the extra money is spent. Should the family save for a coloured television set or for a new convertible car? Thus we are faced with choices all the time.

Even when your mother buys the groceries for the week she must make some economic decisions. Thousands of products are found on the shelves in the store. Out of these she selects what she thinks is best for the family. Which product is the best buy?

Better buying of course, is only one aspect of economics. We all need to learn about this subject. Every day we are constantly faced with economic decisions that we must make. We should have all the facts we need so that we make a wise choice each time.

Average number of syllables per 100 words = $\frac{409 \times 100}{300} = 136.33$

Test 3 - Word Count

In June thousands of high school graduates will look for/10 a job. Some of them will apply for work in/20 a large firm. Before they are hired their ability to/30 do the work will be judged by a group of/40 people. In business the method of hiring is known as/50 the selection process.

The selection process is made up of/60 a number of steps. All of these steps helps a/70 firm to choose the best person out of all who/80 apply.

In the first step a job seeker fills out/90 an application form. Facts about yourself, such as age, weight,/100 height, and health are noted. If you have worked,/110 this is also recorded. The way you complete the form is/120 just as important as the facts you supply. You provide/130 clues about your work habits if the writing is messy/140 and if you do not fill in all the blanks./150 All of the forms are then sorted out. The people/160 who are most suitable are asked to come to an/170 interview.

In an interview the job seeker talks with an/180 employee of the firm--the interviewer. His job is/190 to judge the ability of each person and to write a/200 report of his impressions.

At this time the applicant may/210 also be asked to undergo tests. These tests measure skill/220 and personality traits. Another common test is an examination by/230 a doctor.

Next all the facts that have been gathered/240 are put together. The record for each person is compared/250 against the others. The one who is most likely to/260 do the job well is then chosen. But before he/270 is hired, he will be interviewed by his future boss/280 who has the last approval. Thus you can see finding/290 the right person for each job is no easy task./300

Total Words: 300

Test 3 - Sentence Count

In June thousands of high school graduates will look for a job.[1] Some of them will apply for work in a large firm.[2] Before they are hired their ability to do the work will be judged by a group of people.[3] In business the method of hiring is known as the selection process.[4]

The selection process is made up of a number of steps.[5] All of these steps help a firm to choose the best person out of all who apply.[6]

In the first step a job seeker fills out an application form.[7] Facts about yourself, such as age, weight, height, and health are noted.[8] If you have worked, this is also recorded.[9] The way you complete the form is just as important as the facts you supply.[10] You provide clues about your work habits if the writing is messy and if you do not fill in all the blanks.[11] All of the forms are then sorted out.[12] The people who are most suitable are asked to come to an interview.[13]

In an interview the job seeker talks with an employee of the firm--the interviewer.[14] His job is to judge the ability of each person and to write a report of his impressions.[15]

At this time the applicant may also be asked to undergo tests.[16] These tests measure skill and personality traits.[17] Another common test is an examination by a doctor.[18]

Next all the facts that have been gathered are put together.[19] The record for each person is compared against the others.[20] The one who is most likely to do the job well is then chosen.[21] But before he is hired, he will be interviewed by his future boss who has the last approval.[22] Thus you can see finding the right person for each job is no easy task.[23]

$$\text{Average number of sentences per 100 words} = \frac{23 \times 100}{300} = 7.66$$

$$\text{Average sentence length per 100 words} = \frac{100}{7.66} = 13.068$$

Test 3 - Syllable Count

In June thousands of high school graduates/1 will look for a job. Some of them will apply/2 for work in a large firm. Before they/3 are hired their ability to do/4 the work will be judged by a group of people/5. In business the method of hiring/6 is known as the selection process.

The/7 selection process is made up of a/8 number of steps. All of these steps help a/9 firm to choose the best person out of all/10 who apply.

In the first step a job seeker/11 fills out an application form. Facts/12 about yourself, such as age, weight, height, and/13 health are noted. If you have worked, this is/14 also recorded. The way you complete/15 the form is just as important as the/16 facts you supply. You provide clues about/17 your work habits if the writing is messy/18 and if you do not fill in all the/19 blanks. All of the forms are then sorted out./20 The people who are most suitable are/21 asked to come to an interview.

In an/22 interview the job seeker talks with an/23 employee of the firm--the interviewer/24. His job is to judge the ability/25 of each person and to write a report/26 of his impressions.

At this time the/27 applicant may also be asked to undergo/28 tests. These tests measure skill and personality/29 traits/30. Another common test is an examination by a/31 doctor.

Next all the facts that have been gathered/32 are put together. The record/33 for each person is compared against the/34 others. The one who is most likely to/35 do the job well is then chosen. But before/36 he is hired, he will be interviewed/37 by his future boss who has the last/38 approval. Thus you can see finding the/39 right person for each job is no easy/40 task.

$$\text{Average number of syllables per 100 words} = \frac{401 \times 100}{300} = 133.66$$

Test 1 - Error Load

Do you remember your first lesson in typing? From that first period you began to learn about correct posture. No matter what your level of skill, whether you type ten or fifty words a minute, posture is a major factor that will determine whether you will be a poor, average, or excellent typist. Why is posture vital to your typing progress?

Typing is described as a motor skill. If you can type by touch, this means that when your eyes perceive or look at a word, your fingers will instinctively move to the right keys. Your brain will not make a conscious effort to direct your fingers towards the keys you need to hit to type the word. Thus touch typing, like any other motor habit, involves automatic responses of your body after the habit has been learned.

These are the reasons why posture is important. The way you sit and hold your arms determines how well you can move your fingers. When you sit with your back against the chair, your arms, wrists, and hands are pulled out of proper position. Then your fingers cannot stroke at a quick pace. Feet that do not lie flat on the floor cause uneven left margins in your work. Your hands tend to move too much if your wrists are not level. Posture faults can cause excessive fatigue because the muscles are strained.

An expert claims that 90% of our typing errors can be blamed on poor posture habits. These bad habits are very hard to change. Once a habit is acquired, our body responds in the same way until a new habit replaces it. Therefore the errors caused by poor posture keep repeating themselves on your work. All typists must always keep alert. Safeguard your good posture techniques at all times.

Test 2 - Error Load

If you bring up the subject of economics most people will think about a course that they didn't study in school. They didn't take it because they heard that it was difficult. Others will tell you that they considered it unimportant. This is a pity because we meet and deal with economic problems every day of our lives.

Here is one simple way in which we can think about economics. When we do not have enough to satisfy all our needs, we must plan to use what is available in the best way possible. In this manner we can get the greatest satisfaction out of the resources we own. Let's see how this applies in our daily living.

When your father brings home his salary, there are all kinds of things on which the money can be spent. The telephone and light bills represent items which must be paid. Then cash must be put aside for food. When all of the expenses that must be paid have been taken care of, then the family can decide how the extra money is spent. Should the family save for a coloured television set or for a new convertible car? Thus we are faced with choices all the time.

Even when your mother buys the groceries for the week she must make some economic decisions. Thousands of products are found on the shelves in the store. Out of these she selects what she thinks is best for the family. Which product is the best buy?

Better buying of course, is only one aspect of economics. We all need to learn about this subject. Every day we are constantly faced with economic decisions that we must make. We should have all the facts we need so that we make a wise choice each time.

Test 3 - Error Load

In June thousands of high school graduates will look for a job. Some of them will apply for work in a large firm. Before they are hired their ability to do the work will be judged by a group of people. In business the method of hiring is known as the selection process.

The selection process is made up of a number of steps. All of these steps help a firm to choose the best person out of all who apply.

In the first step a job seeker fills out an application form. Facts about yourself such as age, weight, height, and health are noted. If you have worked, this is also recorded. The way you complete the form is just as important as the facts you supply. You provide clues about your work habits if the writing is messy and if you do not fill in all the blanks. All of the forms are then sorted out. The people who are most suitable are asked to come to an interview.

In an interview the job seeker talks with an employee of the firm--the interviewer. His job is to judge the ability of each person and to write a report of his impressions.

At this time the applicant may also be asked to undergo tests. These tests measure skill and personality traits. Another common test is an examination by a doctor.

Next all the facts that have been gathered are put together. The record for each person is compared against the others. The one who is most likely to do the job well is then chosen. But before he is hired, he will be interviewed by his future boss who has the last approval. Thus you can see finding the right person for each job is no easy task.

GENERAL DIRECTIONS FOR STUDENTS

1. You are writing these tests for research purposes only. The scores you make have no effect on your grades in your regular work. Your participation in this study is greatly appreciated by the investigator.

2. These tests are designed to compare different methods of reading in finding errors. It is absolutely necessary for you to follow the directions correctly.

3. This is the general procedure you follow. You will find two sets of papers. The material on the short page are paragraphs that were copied on a 5-minute timed writing. The material on the long page represent the copy that was typed on a 5-minute timed writing. You must find the errors which the typist made and circle or underline them.

4. You will start by reading the copy on the short page. After everyone has finished, your teacher will review the reading directions with you. Be sure you understand the method of reading and follow it exactly. Do not start the test until you are given a signal.

5. You may make use of both sheets as you write the test. Read at your normal rate. Do not rush or slow down too much. There is no time limit. When you finish, note the time using the last number written on the chalkboard.

Once more, thank you for your participation.

DIRECTIONS FOR THE TEST ADMINISTRATOR

The students should understand what constitutes an error in typing before the tests are administered.

Please follow the directions exactly so that the results will be reliable. Give the tests in alphabetical order at the start of the class on three separate days.

A. Distribute the tests face down on the desks and ask students not to start until you give them a signal.

B. Read the GENERAL DIRECTIONS FOR STUDENTS aloud with the class, answering any questions they may have.

C. Ask students to fill in their names at the top of the test.

D. Ask the students to read the copy on the short page, but not to start the test. When all students have finished reading, start them on the test. It is essential that none of them begin the test until everyone has finished reading the material on the short page once.

E. Review the reading directions at the top of the test by reading the directions aloud. Start the class by giving a signal.

F. After the students begin, record the time in half minutes on the chalkboard. eg. 1
$1\frac{1}{2}$
2
$2\frac{1}{2}$
3
etc.

Your assistance in this study is greatly appreciated.

MARKING SUMMARY SHEET

Name _____ School _____

Div. _____

Age _____ Sex _____ Grade _____ IQ _____

Reading _____ _____

_____ _____

Test A Time _____ Vertical Horizontal

1	2	3	4	5	6	7	Total	1	2	3	4	1	2	3	4

Test B Time _____ Vertical Horizontal

1	2	3	4	5	6	7	Total	1	2	3	4	1	2	3	4

Test C Time _____ Vertical Horizontal

1	2	3	4	5	6	7	Total	1	2	3	4	1	2	3	4

Number _____

APPENDIX H. MULTIVARIATE ANALYSIS OF COVARIANCE

Dependent Variables: Total Amount of Time and Total Number of Errors

Covariate: IQ

Source	Log (Generalized Variance)	U Statistic	Degrees of Freedom			Approximate F Statistic	Degrees of Freedom	
P*	17.77878	0.964115	2	1	503	9.3424	2	502
R**	18.11125	0.691413	2	2	503	50.8597	4	1004
S(P)***	19.50203	0.172080	2	252	503	2.8101	504	1004
PR	17.79404	0.949515	2	2	503	6.5863	4	1004
Covariate 1	17.89983	0.991195	2	1	503	2.2296	2	502
RS(P)	17.74223							

Approximate $F_{(2, 502)} = 2.229$, $p > .05$.

*Paper - Coloured vs White

**Repetition - 0, 1, 2 Repetitions

***Subjects 1 27

APPENDIX I. ANALYSIS OF VARIANCE FOR IQ SCORES

Source	Error Term	F	Sum of Squares	Deg. of Freedom	Mean Square
1 Mean	S(P)		15108.20	1	15108.20
2 P*	S(P)	0.1384	.9567000	1	.9567000
3 R**	RS(P)	-0.0000	.0	2	.0
4 S(P)***			1741.789	252	6.911900

$F_{(1, 252)} = .138,\ p > .05$

*Paper - Coloured vs White

**Repetition - 0, 1, 2 repetitions

***Subjects - 127

APPENDIX J. ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE (TOTAL AMOUNT OF TIME/ MINUTES

Source	Error Term	F	Sum of Squares	Deg. of Freedom	Mean Square
1 Mean	S(P)		1200447.	1	1200447.
2 P*	S(P)	.0635	20.49219	1	20.49219
3 R**	SR(P)	109.1139	16514.81	2	8257.402
4 S(P)***			109651.8	340	322.5051
5 PR	SR(P)	25.7223	3893.172	2	1946.586
6 SR(P)			51460.27	680	75.67685

*Paper - Coloured vs White

**Repetition - 0, 1, 2 repetitions

***Subjects - 171

APPENDIX K. ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE (TOTAL NUMBER OF ERRORS)

Source	Error Term	F	Sum of Squares	Deg. of Freedom	Mean Square
1 Mean	S(P)		22167.02	1	22167.02
2 P*	S(P)	5,1571	45.89571	1	45.89571
3 R**	SR(P)	73.7409	323.7559	2	161.8779
4 S(P)***			3025.844	340	8.899540
5 PR	SR(P)	1.5749	6.914551	2	3.457275
6 SR(P)			1492.753	680	2.195225

*Paper - Coloured vs White

**Repetition - 0, 1, 2 repetitions

***Subjects - 171

APPENDIX L. ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE (MEAN NUMBER OF ERRORS BY TYPE)

Source	Error Term	F	Sum of Squares	Deg. of Freedom	Mean Square
1 Mean	S(P)		3130.961	1	3130.961
2 P*	S(P)	4.6985	5.908660	1	5.908660
3 R**	SR(P)	77.2212	48.52568	2	24.26283
#4 T***	ST(P)	289.9219	626.4341	6	104.4057
5 S(P)****			427.5732	340	1.257568
6 PR	SR(P)	.6453	.4055176	2	.2027588
#7 PT	ST(P)	2.7793	6.005127	6	1.000854
#8 RT	SRT(P)	64.6662	190.6331	12	15.88609
9 SR(P)			213.6553	680	.3141989
10 ST(P)			734.6375	2040	.3601164
#11 PRT	SRT(P)	1.9075	5.623291	12	.4686075
12 SRT(P)			1002.304	4080	.2456626

*Paper - Coloured vs White
**Repetition - 0, 1, 2 Repetitions
***Types of Errors - 7
****Subjects - 171
#Effects with # are of major concern in this analysis

APPENDIX M. ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE (PERCENTAGE OF ERRORS BY VERTICAL QUARTILES)

Source	Error Term	F	Sum of Squares	Deg. of Freedom	Mean Square
1 Mean	S(P)		420.9211	1	420.9211
2 P*	S(P)	3.4107	.6289213	1	.6289213
3 R**	SR(P)	90.2858	8.735868	2	4.367933
#4 Q***	SQ(P)	134.7265	17.26357	3	5.754521
5 S(P)****			62.69472	340	.1843962
6 PR	SR(P)	.2002	.0193710	2	.0096855
#7 PQ	SQ(P)	2.4431	.3130493	3	.1043497
#8 RQ	SRQ(P)	59.0150	14.20763	6	2.367937
9 SR(P)			32.89767	680	.0483789
10 SQ(P)			43.56686	1020	.0427126
#11 PRQ	SRQ(P)	.8584	.2066574	6	.0344429
12 SRQ(P)			81.85364	2040	.0401243

*Paper - Coloured vs White
**Repetition - 0, 1, 2 Repetitions
***Quartiles - Numbered consecutively from left side of page
****Subjects - 171
#Effects with # are of major concern in this analysis

APPENDIX N. ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE (PERCENTAGE OF ERRORS BY HORIZONTAL QUARTILES)

Source	Error Term	F	Sum of Squares	Deg. of Freedom	Mean Square
1 Mean	S(P)		425.9351	1	425.9351
2 P*	S(P)	3.9463	.7471647	1	.7471647
3 R**	SR(P)	41.7515	4.078267	2	2.039133
#4 Q***	SQ(P)	205.5979	25.60916	3	8.536386
5 S(P)****			64.37245	340	.1893307
6 PR	SR(P)	.5915	.0577774	2	.0288887
#7 PQ	SQ(P)	4.7212	.5880737	3	.1960245
#8 RQ	SRQ(P)	89.3007	23.42557	6	3.904261
9 SR(P)			33.21104	680	.0488398
10 SQ(P)			42.35020	1020	.0415198
#11 PRQ	SRQ(P)	1.2624	.3311615	6	.0551936
12 SRQ(P)			89.18956	2040	.0437204

*Paper - Coloured vs White

**Repetitions - 0, 1, 2 Repetitions

***Quartiles - Numbered consecutively from top of page

****Subjects - 171

#Effects with # are of major concern in this analysis

Test A

Name _____ Time _____

School _____

Directions: See if you can find all the errors in the paragraphs below. Circle each error as you read the copy. Do not read the copy more than once. Mark the number of minutes at the top of the page when you finish. Wait for the signal to start.

Do you remember your first lesson in typing? From that first period you began to learn about correct posture. No mater what your level of skill, whehter you type ten or fifty words a minute, posture is a major factor that will determine whether you will be a poor, average, or excellent typist. Why is posture vital to your typing progress?

Typing is described as a motor skill. If you can type by touch, thismeans that when your eyes perceive or look at a word, your fingers will instinctively move to the rigt keys. Your brain will not make a conscious effort to direct your fingers totowards the keys you need to hit to type the word. Thus touch typing, like any other motor habit, involves automatic responses of you body after the habit has been learned.

These are the reasons why posture is important. The way you and sit hold your arms determines how well you can move your fingers. When you sit with your back against the chair, your arms, wrists, an hands are pulled out of of proper position. Then your fingers cannot stroke at a quick pace. Feet that do not lie flat on the floor cause uneven left margins in your work. Your hands tend to move too much if your wrists are not level. Posture faults can cause excesive fatigue because the muscles are strained.

An expert claims that 90% of our typing errors can be blamed on poor postrue habits. These bad habits are very hard to change. Once a habt is acquired, our body responds in the same way until a new habit replaces it. Therefore the errors caused by poor posture keep repeating themselves on your work. All typists must always keep alert. Safeguard your good posture techniques all at times.

Score

1	2	3	4	5	6	7	Total

Test A

Name _____ Time _____

School _____

Directions: See if you can find all the errors in the paragraphs below. Circle each error as you read the copy. Do not read the copy more than once. Mark the number of minutes at the top of the page when you finish. Wait for the signal to start.

Do you remember your first lesson in typing? From that first period you began to learn about correct posture. No mater what your level of skill, whehter you type ten or fifty words a minute, posture is a major factor that will determine whether you will be a poor, average, or excellent typist. Why is posture vital to your typing progress?

Typing is described as a motor skill. If you can type by touch, thismeans that when your eyes perceive or look at a word, your fingers will instinctively move to the rigt keys. Your brain will not make a conscious effort to direct your fingers totowards the keys you need to hit to type the word. Thus touch typing, like any other motor habit, involves automatic responses of you body after the habit has been learned.

These are the reasons why posture is important. The way you and sit hold your arms determines how well you can move your fingers. When you sit with your back against the chair, your arms, wrists, an hands are pulled out of of proper position. Then your fingers cannot stroke at a quick pace. Feet that do not lie flat on the floor cause uneven left margins in your work. Your hands tend to move too much if your wrists are not level. Posture faults can cause excesive fatigue because the muscles are strained.

An expert claims that 90% of our typing errors can be blamed on poor postrue habits. These bad habits are very hard to change. Once a habt is acquired, our body responds in the same way until a new habit replaces it. Therefore the errors caused by poor posture keep repeating themselves on your work. All typists must always keep alert. Safeguard your good posture techniques all at times.

Score

1	2	3	4	5	6	7	Total

Do you remember your first lesson in typing? From that first period you began to learn about correct posture. No matter what your level of skill, whether you type ten or fifty words a minute, posture is a major factor that will determine whether you will be a poor, average, or excellent typist. Why is posture vital to your typing progress?

Typing is described as a motor skill. If you can type by touch, this means that when your eyes perceive or look at a word, your fingers will instinctively move to the right keys. Your brain will not make a conscious effort to direct your fingers towards the keys you need to hit to type the word. Thus touch typing, like any other motor habit, involves automatic responses of your body after the habit has been learned.

These are the reasons why posture is important. The way you sit and hold your arms determines how well you can move your fingers. When you sit with your back against the chair, your arms, wrists, and hands are pulled out of proper position. Then your fingers cannot stroke at a quick pace. Feet that do not lie flat on the floor cause uneven left margins in your work. Your hands tend to move too much if your wrists are not level. Posture faults can cause excessive fatigue because the muscles are strained.

An expert claims that 90% of our typing errors can be blamed on poor posture habits. These bad habits are very hard to change. Once a habit is acquired, our body responds in the same way until a new habit replaces it. Therefore the errors caused by poor posture keep repeating themselves on your work. All typists must always keep alert. Safeguard your good posture techniques at all times.

Test B

Name _____ Time _____

Directions: Read the copy through once. Circle errors on the second reading. Do not read the copy again. Note the time at the top of the page when you finish.

In June thousands of high school graduates will look for a job. Some of them will apply for work in a large firm. Before they are hired their ability do to the work will be judged by a group of peopleple. In business the method of hiring is knon as the selection process.

The selection process is made up of a number of steps. All of these steps help a firm to choose the best person out ofall who apply.

In the first step a job seeker fills out an application form. Facts about yoursefl, such as age, weight, height, and health are noted. Of you have worked, this is also recorded. The way you complete the form is just as important as the facts you suply. You provide clues about your work habits if the writing is messy and if you do not fill in all the blanks. All of the forms are then sorted out. The people who are most siutable are asked to come to an interview.

In an interview the job seeker talks with an employee the of firm --the interviewer. His job is to judge the ability of each person and to write a report of his impresions.

At this time the applicant may also be asked to undergo tests. These tests measure skill and personality traits. Another common test is an examination by a doctor.

Next all the facts that have been gathred are put together. The rerecord for each person is compared against the others. The one who is most likely to do them job well is then chosen. But before he is hired, he will be interviewed by his future boss who has the last approval. Thus you can see finding the right person for each job is no easy task.

Score

1	2	3	4	5	6	7	Total

Test B

Name _____ Time _____

Directions: Read the copy through once. Circle errors on the second reading. Do not read the copy again. Note the time at the top of the page when you finish.

In June thousands of high school graduates will look for a job. Some of them will apply for work in a large firm. Before they are hired their ability do to the work will be judged by a group of peopleple. In business the method of hiring is knon as the selection process.

The selection process is made up of a number of steps. All of these steps help a firm to choose the best person out ofall who apply.

In the first step a job seeker fills out an application form. Facts about yoursefl, such as age, weight, height, and health are noted. Of you have worked, this is also recorded. The way you complete the form is just as important as the facts you suply. You provide clues about your work habits if the writing is messy and if you do not fill in all the blanks. All of the forms are then sorted out. The people who are most siutable are asked to come to an interview.

In an interview the job seeker talks with an employee the of firm --the interviewer. His job is to judge the ability of each person and to write a report of his impresions.

At this time the applicant may also be asked to undergo tests. These tests measure skill and personality traits. Another common test is an examination by a doctor.

Next all the facts that have been gathred are put together. The rerecord for each person is compared against the others. The one who is most likely to do them job well is then chosen. But before he is hired, he will be interviewed by his future boss who has the last approval. Thus you can see finding the right person for each job is no easy task.

Score

1	2	3	4	5	6	7	Total

In June thousands of high school graduates will look for a job. Some of them will apply for work in a large firm. Before they are hired their ability to do the work will be judged by a group of people. In business the method of hiring is known as the selection process.

The selection process is made up of a number of steps. All of these steps help a firm to choose the best person out of all who apply.

In the first step a job seeker fills out an application form. Facts about yourself, such as age, weight, height, and health are noted. If you have worked, this is also recorded. The way you complete the form is just as important as the facts you supply. You provide clues about your work habits if the writing is messy and if you do not fill in all the blanks. All of the forms are then sorted out. The people who are most suitable are asked to come to an interview.

In an interview the job seeker talks with an employee of the firm --the interviewer. His job is to judge the ability of each person and to write a report of his impressions.

At this time the applicant may also be asked to undergo tests. These tests measure skill and personality traits. Another common test is an examination by a doctor.

Next all the facts that have been gathered are put together. The record for each person is compared against the others. The one who is most likely to do the job well is then chosen. But before he is hired, he will be interviewed by his future boss who has the last approval. Thus you can see finding the right person for each job is no easy task.

Test C

Name _____ Time _____

Directions: Read the copy through once. Circle errors on the second reading. Read the copy for the third time and circle any errors you may have missed. Do not read the copy again. Note the time at the top of the page when you finish.

If you bring up the subject of economics most people will think about a course that they didn't study in school. They didn't take it because they heard that was it difficult. Others will tell you that they considered it unimportant. This is a pity because we meet and deal with economic problems every day of our lives.

Here is one simple way inn which we can think about econonmics. When we do not have enough to satisfy all our needs, we must plan to use what is availble in the best way possible. In this maner we can get the greatest satisfaction out of the resources we own. Let's see how this applies in our daily living.

When your father brings home his salary, there are all kindsof things on wihch the money can be spent. The telephone and light bills represent items which must be paid. Then cash must be put aside for food. When all of the expenses that must be paid have been taken care of, then the family can decide how the exextra money is spent. Should the family save from a coloured television set or for a new convertible car? Thus we are faced with choices all the time.

Even when your mother buys the groceries the for week she must make some economic decisions. Thousands of products are found on the shelves in the store. Out of these she selects what she thinks is best for the family. Which product is the best buy?

Better buying of course, is only one aspect of economics. We all need to learn about this subject. Evry day we are constantly faced wiht economic decisions that we must make. We should have all the facts we ned so that we make a wise choice each time.

Score

1	2	3	4	5	6	7	Total