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MATERIALS OF THE UNITED STATES COAST GUARD
INSTITUTE.

The University of Oklahoma, Ed.D., 1974
Education, general

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THE UNIVERSITY OF OKLAHOMA
GRADUATE COLLEGE

READABILITY LEVELS OF CORRESPONDENCE STUDY MATERIALS
OF THE UNITED STATES COAST GUARD INSTITUTE

A DISSERTATION
SUBMITTED TO THE GRADUATE FACULTY
in partial fulfillment of the requirements for the
degree of
DOCTOR OF EDUCATION

BY
BILLY J. SILER
Norman, Oklahoma
1973

READABILITY LEVELS OF CORRESPONDENCE STUDY MATERIALS
OF THE UNITED STATES COAST GUARD INSTITUTE

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ACKNOWLEDGEMENTS

The deepest and sincere appreciation is expressed to Dr. Robert F. Bibens who served so ably as chairman of this doctoral committee and Dr. Richard P. Williams who so generously gave his time, encouragement and friendship in directing this study. Gratitude is also extended to other members of the doctoral committee, Dr. Gerald Kidd and Dr. Gene Pingleton for their interest and encouragement in the pursuit of this degree.

The writer wishes to express his warmest appreciation and affection to his wife, Judy, and to his family for their patience and personal sacrifice in order for this study to be completed.

There are many responsible for a person attaining a doctoral degree. This writer would like to express his appreciation to a few, whose influence on his life encouraged him in this effort. His mother and father, Mr. and Mrs. Earl Siler, Mr. L. E. Kelley, high school teacher and coach, Dr. Fred Graves, Professor, Central State University, Mr. Amos Kimberling, Oklahoma State Department of Education, three brothers, Tyson Siler, Jack Siler, Guy Siler, and two sisters, Minnie Lou Matthesen and Betty Siler, and a host of others.

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READABILITY LEVELS OF CORRESPONDENCE STUDY MATERIALS
OF THE UNITED STATES COAST GUARD INSTITUTE

CHAPTER I

THE PROBLEM

Background of the Study

The ability to read well is an important factor in achieving success in any educational endeavor, and may well be the primary factor in determining successful completion of correspondence courses. Unlike the classroom situation where an instructor interprets the material and helps the student to understand study materials, the correspondence courses guide the student to instruct himself, without assistance, by means of written materials alone. Thus, in correspondence study, the student's understanding of materials will depend on two factors: his own reading ability and the readability or reading level of the materials.

When the readability of the written material is above the reading level of the student, development of understanding is difficult. Such is often the situation existing between military materials and trainees, both in residence

training schools and in correspondence training courses. Stricht, Caylor, Kern and Fox concluded from a study conducted in 1971 that a highly significant discrepancy existed.

The content and teaching level of many military training courses and the reading level of many job manuals and other technical materials presupposes literacy levels as high as a college sophomore or higher.¹

Navy technical training materials were found to be above the level of the trainees as a result of a study conducted by Standlee and Fattu.² At least half of the Army maintenance manuals in a 1957 test were found to be above the reading level of those men expected to use them, according to Sleight and Learner.³ Similarly, Air Force researchers Smith and Kincaid, in a study of manuals, reports and training documents found:

The readability of a document greatly influences the time required to extract needed information as well as the probability that the information will be correctly understood and used.⁴

¹Thomas G. Sticht, John S. Caylor, Richard P. Kern and Lynn C. Fox, Determination of Literacy Skill Requirements in Four Military Occupational Specialties (Washington, D.C.: Human Resources Research Organization, 1971), p. 53.

²Lloyd S. Standlee and Nicholas A. Fattu, "Readability of Navy Publications," The Journal of Educational Research, 11 (February, 1956), pp. 471-473.

³R. B. Sleight and H. D. Learner, "Comprehensibility and Readability of Technical Manuals," paper delivered at the meetings of the Eastern Psychological Association, April 13, 1957.

⁴Edgar A. Smith and J. Peter Kincaid, "Derivation and Validation of the Automated Readability Index for use with Technical Materials," Human Factors, XII, pp. 457-464.

Significant reading level differentials between student and material have also been observed in Coast Guard communications. In early 1972, readability formulas were applied to materials used by recruits at the Governor's Island Training Center. About ten percent of the recruits were found to be reading at a level below that of the materials. The mission of the U.S. Coast Guard Institute, located in Oklahoma City, Oklahoma, as assigned by the Commandant, is to provide correspondence courses for Coast Guard training requirements; to develop competitive examinations for the selection of personnel for advancement; and to manage distribution, administration and scoring of the courses and examinations. The ability to perform adequately on many military jobs is determined, to some extent, by the individual's ability to read, listen or handle arithmetic computations. The content and teaching level of many military training courses and the reading level of many job manuals and other technical materials presupposes literacy levels as high as a college sophomore or higher. Men who are below that level, therefore, can be expected to experience difficulty in using instructional material and manuals in training for, or in performance of, their military jobs. As little information is available concerning the literacy skill levels suitable for a given job, classification of men into jobs for which their reading skills are sufficient is also a problem.

Since the elimination of the selective service, many

young prospective recruits are continuing in college or university rather than joining one of the services. All recruiters interviewed have agreed that the average new recruit does not make as high a score on the Armed Forces Qualification Test as his counterpart did during the days of the selective service.

After interviewing recruiters from not only the U.S. Coast Guard but from the other branches of the military, it was agreed that the average new enlistee is not academically as well prepared to cope with correspondence course type material as his counterpart was before selective service was eliminated. The opinion of those recruiters were based on the enlistees performance on the Armed Forces Qualification Test.

With the end of the draft, recruiting has become extremely difficult. It is quite likely that the average level of academic ability of the new recruits will be lower than it has been in the past. These people will have even more trouble with correspondence courses which require a high level of reading ability. A continued policy of requiring correspondence courses for advancement could result in a stagnation of the rate advancement system if course completion rates drop. If the course requirement is dropped, a major training source will be abandoned.⁵

A review of published research on reading levels of students and materials, which will be summarized in Chapter II, indicates that little research has been done concerning correspondence schools in general, and the U.S. Coast Guard Institute in particular.

⁵K. R. Depperman, Commanding Officer, USCG Institute, Oklahoma City, Oklahoma.

Need for the Study

The correspondence courses of the U.S. Coast Guard Institute comprise the major segment of the enlisted Coast Guardsman's training for advancement. Upon enlistment, each man is administered the Armed Forces Qualification Test (AFQT) and sent as a seaman recruit (E-1) to a basic training center (boot camp) for twelve weeks of military familiarization and training. The seaman recruit is graduated from basic training with the E-2 pay grade. Only after six months of service from date of enlistment, successful completion of the seaman or fireman correspondence course and recommendation by his commanding officer, can the E-2 enlisted man attain the E-3 pay grade. A Coast Guardsman may pursue one of three alternative procedures for advancement to E-4. If the seaman recruit has qualified on the basis of his GCT scores, he may elect to go to a Class A residence training school to learn his specialty. After promotion to E-3, he may be sent to a duty station where he must compete service-wide for E-4 pay grade for promotion when a vacancy occurs.

The man qualified for the Class A school may request assignment to a duty station directly after boot camp where he may enroll in the basic correspondence course and a second course for his specialty. After completing this first course and being promoted to E-3, he may then request training at the Class A school. Using this method, he is assured of E-4 pay grade on graduation from Class A school. If his rate is

E-2 when assigned to a Class A school, he will advance to E-3 pay grade upon graduation.

The man who does not qualify for the Class A school or the one who does not wish or have the opportunity to attend such a school may request assignment to regular duty as an E-2 after boot camp where he may enroll in the basic correspondence course for Seaman or Fireman. After completion of the correspondence course and recommendation by his commanding officer, he is advanced to E-3. He may then strike for E-4 in his proposed specialty. Striking involves on-the-job training as well as enrolling in a correspondence course for E-4 in his specialty. After completion of the E-4 correspondence course, he will be expected to participate in the servicewide examination competition.

Advancement beyond E-4 also requires completion of correspondence courses and servicewide examination competition. Thus, the correspondence courses from the U.S. Coast Guard Institute touch the lives and the promotion of all enlisted personnel in the Coast Guard at one time or another. The successful completion of these courses may depend largely on the reading skill of the Coast Guardsmen. If they do not fully comprehend the materials, they will not be adequately trained to perform their duties. When this happens, the men as well as the Coast Guard lose. The men lose out on the additional dollars that promotions bring, and the Coast Guard

loses dollars spent for training and ineffective performance of duties.

Limitations of the Study

The U.S. Coast Guard Institute enrolls enlisted men, officers and personnel in other branches of the armed forces, but this study will be limited to enlisted men in the U.S. Coast Guard who entered service after July 1, 1972, and have graduated from basic training. The study will be delimited in terms of those variables the standardized test instruments purport to assess.

Hypotheses

In view of the previous research findings, the following null hypotheses will be tested:

Ho₁: There is no statistically significant relationship between the obtained scores on the Armed Forces Qualification Test and the obtained scores on the California Achievement Test, Level IV.

Ho₂: There is no statistically significant relationship between the obtained scores for the sample on the Armed Forces Qualification Test and the obtained scores for the sample on the General Classification Test.

Statement of the Problem

The purpose of this study was to determine the readability level of U.S. Coast Guard Institute Correspondence Study Materials in fifteen subject areas, and to determine

the mean reading level of a sample of enlisted personnel as measured by the California Achievement Test, Level IV, Reading Subtest.

The Objectives of the Study

The objectives of this study will be to utilize the Gunning Fog and Dale-Chall readability formulas to assess the readability levels of the U.S. Coast Guard Institute correspondence study materials in fifteen subject areas in an attempt to answer the following questions:

1. What is the readability level of the U.S. Coast Guard correspondence course study material for each of the fifteen subject areas?

2. What is the obtained mean score for the sample for the California Achievement Test, Level IV, Reading Subtest?

3. What is the reading level of the U.S. Coast Guardsmen as reflected in this acquired sample?

4. Is there a difference between the reading level of the U.S. Coast Guardsmen and the readability level of the correspondence course study materials they use?

Definition of Terms

1. A.F.Q.T.: Armed Forces Qualification Test. A test given all members of the Armed Forces. Each branch of the service has different requirements as to the score a recruit is expected to make before he is enlisted.

2. Recruit: An enlisted person who is undertaking military basic training.
3. Correspondence Course: A course of instruction in which the method of communication between instructor and student is written correspondence.
4. End of Course Exam: The test given to personnel who have successfully completed the series of lessons specified for a specific correspondence course. A passing score on this test permits the student to graduate from the course.
5. Rate: Military designation for pay grade classification.
6. Readability Level: The grade level at which material is written. In this study readability levels of materials will be assessed using the Gunning Fog Index and the Dale-Chall Formula.
7. Reading Level: The level of reading ability, expressed as grade level score on a standardized reading test. In this study, the California Reading Test, Level IV, Subtest, will be used to assess the reading level of the personnel in the sample.
8. GCT: General Classification Test. The General Classification Test is a standardized instrument used by the Armed Forces to assess basic ability.
9. SWE: Servicewide Examination. The U.S. Coast Guard intraservice competitive examination administered semi-annually to measure the level of knowledge of

the testee's particular rate. The examination is 150 questions in length and covers professional as well as military areas. Promotion is based on the score on this examination, time in service, time in grade, performance marks, awards, and the number of openings in the higher rate/rank.

10. Striker: A trainee in a rate, i.e. apprentice on a skilled job.

Organization of the Report

Results of the study will be presented through tables and discussion. Chapter I presents an overview of the problem and need for the study. Chapter II contains a review of related research. The research design and analysis of data is presented in Chapter III, and Chapter IV will contain a summary of the findings. The summary, conclusions, and the recommendations resulting from the study is found in Chapter V.

CHAPTER II

REVIEW OF LITERATURE

Readability Levels

The costly effects of inadequate communication are widespread and well known. Several attempts have been made to quantify the difficulty level of writing by using formulas. Flesch¹ launched a very successful career by developing the Flesch Count--A formula that measures readability in terms of a measure of word difficulty (the number of syllables per word) and sentence difficulty (words per sentence). McLaughlin² pointed out the linguistic nature of reading difficulty factors in an explanation of reading formula.

A reading formula is simply a mathematical equation derived by regression analysis. This procedure finds the equation which best expresses the relationship between two variables, which in this case are measures of the difficulty experienced by people reading a given text. This formula can then be used to predict reading difficulty from the linguistic characteristics of other texts. The linguistic measures which have been found

¹Rudolph Flesch, "A New Readability Yardstick," Journal of Applied Psychology, XXXII (1957), pp. 221-233.

²Harry McLaughlin, "Smog Grading--A New Readability Formula," Journal of Reading, XII, No. 8 (May, 1969), pp. 639-646.

to have greatest predictive power are word and sentence length. These measures are, respectively, indicators of semantic and syntactic sources of reading difficulty.

Material that contains short sentences and easy words is more useful to the reader because it is better understandable than the long complicated sentences. Excellent general reviews of the literature on the subject of readability measurement have been published by Chall³ and Klare.⁴ Readability formulas have been successful in controlling readability of material to which they have been applied. Readability has been viewed as an interaction process by Dale and Chall.⁵

In the broadest sense, readability is the sum total (including the interactions of all those elements within a given piece of printed material that affects the success a group of readers have with it). The success is the extent to which they understand it, react at an optimum speed and find it interesting.

Flesch,⁶ Dale and Chall⁷ and Lorge,⁸ as originators of formulas, have suggested modification from time to time to

³Jeanne S. Chall, Readability--An Appraisal of Research and Application (Columbus, Ohio: Ohio State University Bureau of Educational Monographs, 1958).

⁴G. R. Klare, The Measurement of Readability (Ames, Iowa: Iowa State University Press, 1963).

⁵Chall, op. cit.

⁶Flesch, op. cit.

⁷Chall, op. cit.

⁸Irving Lorge, "Word Lists as Background for Communication," Teacher's College Record, XLV (May, 1944), pp. 543-552.

simplify the formula or to improve validity.

Readability research has given us information regarding how long sentences can be, on the average, before they discourage the reader. Robert Gunning,⁹ who first presented the idea of counting poly-syllabic words to obtain a measure of semantic difficulty, explained the aim of readability research as an attempt to single out those factors of writing style that can be measured, followed by determination of the degree to which each affects readability.

Reading Ability

Readability research has been primarily directed toward reading materials, but researchers have not failed to consider the reading abilities of readers. Marksheffel¹⁰ explained that the efficiency with which a person reads depends greatly upon his basic reading skills, his background of experiences in the area in which he is reading, his interest in the material, the difficulty of the material and his purpose(s) for reading. According to Klare,

More readable written material is likely to produce greater comprehension, learning and retention than less readable only when one or more of the following factors are present: the less readable is much harder than the more readable, and clearly beyond the reader's usual level; reading time is limited; the reader does not have a large amount of background or experience with

⁹Robert Gunning, The Technique of Clear Writing (Toronto: McGraw-Hill, 1968).

¹⁰Ned D. Marksheffel, Improving Reading In The Secondary School (New York: Ronald Press, 1966), p. 87.

the topic being covered; and the reader has a relatively strong set to learn.¹¹

Sargent¹² has explained that research results show that progress in certain skills of reading is most rapid and reaches maturity at different times in the continuum from primary grades to college. The ability to understand and critically interpret content material in secondary school and college classes requires a level of intellectual maturity, an extended vocabulary, a wide background of experience and a mastery of language forms not evidenced by, or characteristic of, elementary students.

In trying to impose some coordinating conceptual framework upon the phenomena subsumed under reading and difficulty, Cromer and Wiener¹³ point out the problem of definition.

The real issues arise from different conceptions of the nature of the reading process itself and of the learning processes, sets and principles to be stressed. All definitions that focus on meaning or comprehension imply language as an antecedent, but do not necessarily offer a basis for identifying poor reading as a reading difficulty rather than as a language difficulty.

Even if the issue were resolved in either direction, the definition of sub-skills would present problems in reading

¹¹Klare, op. cit., p. 17.

¹²Eileen E. Sargent, "Integrating Reading Skills In The Content Areas," Fusing Reading Skills and Content (Newark, Delaware: International Reading Association, 1969), pp. 17-25.

¹³Morton Wiener and Ward Cromer, "Reading and Reading Difficulty: A Conceptual Analysis," Harvard Educational Review, XXXVII (Fall, 1967), pp. 620-630.

research studies. Rystrom¹⁴ pointed out that readability and reading ability studies are complex because comprehension can be defined in six different skill areas: vocabulary, syntax, item recall, item sequence, interpretation and evaluation, and some could be appropriately placed in more than one category.

In English, word length is associated with precise vocabulary, so a reader must usually make extra effort in order to identify the full meaning of a long word, simply because it is precise. Long sentences nearly always have complex grammatical structure, which is a strain on the reader's immediate memory because he has to retain several parts of each sentence before he can combine them into a meaningful whole. Crane¹⁵ explained the responsibility which high schools have for meeting reading needs.

Since reading constitutes about eighty-five per cent of a typical study exercise, it is easy to understand why inadequate readers often experience frustration as they attempt to comprehend reading materials in the content areas. . . . The high school has a very definite responsibility to provide means to make reading experiences of the non-college bound students more worthwhile and functional.

¹⁴Richard Rystrom, "Toward Defining Comprehension: A Second Report," Journal of Reading Behavior, II (Spring, 1970), pp. 144-148.

¹⁵Crane, August, "Meeting The Reading Needs of the Non-College Bound High School Student," Journal of The Reading Specialist (October, 1967), pp. 26, 39.

Williams¹⁶ reported a study of seventy-five college freshmen which was undertaken to measure how much was comprehended by college freshmen before reading a passage and how much meaning was taken from the printed page after reading. All subjects but five made a positive gain in comprehension after reading the passage of material taken from individualized self-instruction material. He concluded that different subjects bring different amounts of meaning to the printed page and that apparently comprehension will increase from reading, unless a severe comprehension problem exists or the reader becomes bored. He recommended further research to establish a predictable scale of expected comprehension when different amounts of comprehension are brought to the printed page.

Reading rates are individual characteristics of readers and should be remembered in studies assessing reading ability. Grob¹⁷ found reading rate ranges from 200 to 350 words per minute among secondary level students who tested at or above grade level on standardized reading tests. He pointed out that we must consider normal test periods while studying, frequent stops to check information, frequent re-readings to insure adequate grasp of concepts, reading and

¹⁶Richard P. Williams, "Predicting Comprehension Gains of College Freshmen," Journal of Reading Behavior, II (Spring, 1970).

¹⁷James A. Grob, "Reading Rate and Study Time Demands," Journal of Reading, XIII (1969), pp. 285-288.

analysis of maps, charts, graphs and reading and working with study aid questions at the end of the chapter text. Efficient readers vary their reading rates according to the task. Harris¹⁸ reported that most readers are rigid rather than flexible in their reading rate.

Cloze Technique

A more recent development in measuring readability makes use of the cloze procedure and was originally described by Taylor¹⁹ as a new psychological tool for measuring the effectiveness of communication. The cloze system systematically deletes words in a prose selection and evaluates the success a reader has in successfully supplying the words deleted. According to proponents of the method, the cloze procedure takes into account concepts and language structure not generally dealt with by other formula.

Beard²⁰ used ten randomly selected instructional passages of 250 words from each of four high school textbooks in biology, American Government and World History for a cloze test with a sample of 250 beginning tenth grade students. He

¹⁸Albert J. Harris, "Research On Some Aspects of Comprehension: Rate, Flexibility and Study Skills," Journal of Reading, XII (December, 1968), pp. 205-210.

¹⁹W. L. Taylor, "Cloze Procedure: A New Tool for Measuring Readability," Journalism Quarterly, XXX (1953), pp. 415-433.

²⁰Jacob G. Beard, "Comprehensibility of High School Textbooks: Association With Content Area," Journal of Reading, XI (December, 1969), pp. 229-233.

found that the average level of difficulty as measured by cloze scores or by terminal unit (T unit) length did not differ significantly among the subject matter content areas. Bormuth²¹ compared cloze scores with amount learned from sample passages and found a high relationship (.92) between the comprehensibility of passages as measured by the cloze scores and learning from them.

Klare²² noted the desirable characteristics of the cloze procedure as a criterion measure, but also pointed out that there are still areas of disagreement about the use of cloze tests as comprehension measures. Kingston and Weaver²³ believe that the cloze technique will increase in use.

With the present availability of computers it seems likely that cloze techniques will become more widely used. As Bormuth notes, readability analysis can readily be computerized and cloze procedures seem to yield more precise predictions than those attained previously by the older formulas.

A number of experts, however, have reservations about the cloze procedure. The major weakness of readability

²¹John R. Bormuth, "Validities of Grammatical and Semantic Classifications of Cloze Test Scores," in J. A. Figurel (ed.) Reading and Inquiry, Proceedings of the International Reading Association, X, Newark, Delaware: (1965), pp. 283-286.

²²George R. Klare, "Comments on Bormuth's Readability: A New Approach," Reading Research Quarterly, I (Summer, 1966), pp. 119-125.

²³Albert J. Kingston and Wendell W. Weaver, "Recent Developments in Readability Appraisal," Journal of Reading, XI (October, 1967), pp. 44-47.

formulas, both the historical ones and the new ones, is that with few exceptions they depend upon correlational techniques alone to establish measures which in actuality are only assumed to predict reading difficulty.

Studies of Military Materials

The military services make extensive use of written technical materials such as manuals, reports and training documents and have contracted research studies to determine success with materials and readability levels.

Klare, Shuford and Nichols²⁴ demonstrated that technical military training material that was easy to read resulted in higher recall scores than did more difficult versions, as measured by the Flesch and Dale-Chall formulas. Klare, Mabry and Gustafson²⁵ found that style difficulty had some effect upon the reading time and retention of technical material used by male airmen. In their controlled experiment with 989 airmen, various versions of reading materials were used which were prepared on three levels of reading difficulty, as measured by the Flesch Readability Formula. Results indicated that the easier style of writing may result

²⁴G. R. Klare, E. H. Shuford and W. A. Nichols, "The Relationship of Style Difficulty, Practice and Ability to Efficiency and Retention," Journal of Applied Psychology, XLI (1957), pp. 222-226.

²⁵George R. Klare, James E. Mabry, and Leonard M. Gustafson, "The Relationship of Style Difficulty to Immediate Retention and to Acceptability of Technical Material," Journal of Educational Psychology, XLVI (May, 1955), pp. 287-295.

in greater and more complete immediate retention, greater amount read in a given time, and more "acceptable" reading material.

Sleight and Learner²⁶ analyzed the difficulty of a sample of Army maintenance manuals and obtained a positive correlation between reading ease scores (determined from the Flesch formula) and comprehension test scores. Flesch scores indicated that at least half of the material was above the reading ability of the subjects. Navy technical training material was analyzed for difficulty using the Farr-Jenkins-Patterson and the Dale-Chall Formulas and reported in a study by Mowry, Webb and Garvin.²⁷ Both formulas showed that much of the material was above the reading ability level of trainees.

In October 1966, the Department of Defense lowered its mental and physical standards for accepting men into military service. Since that date, men who score as low as the 10th percentile on the Armed Forces Qualification Test (AFQT) are acceptable, provided they also pass certain supplementary aptitude tests. Also, men who previously would have been ineligible because of physical defects are now

²⁶R. B. Sleight and H. D. Learner, "Comprehensibility and Readability of Technical Manuals," paper delivered at the meetings of the Eastern Psychological Association, April 13, 1957.

²⁷H. W. Mowry, W. B. Webb and E. A. Garvin, "Readability of Instructional Materials and Methods for Analyzing," report for Office of Naval Research Contract Number 816 (02), AD 81221 (undated).

considered acceptable if their physical defects may be easily corrected, one example being excessive weight. Fisher²⁸ reported a study of 3,000 military personnel accepted into the service classified as "new standards" who were relatively low in literacy skills. After twenty-three months, analysis revealed that literacy status had little or no relationship with most indices of military performance and status. The large majority, however, were assigned to jobs which did not require high verbal ability.

Standlee and Fattu²⁹ analyzed eight Navy publications for readability. They analyzed a basic recruit training text reference manual, four training manuals for Navy occupational groupings having lower general classification test requirements, a history of the Navy used as collateral material for any level of instruction, a house organ publication for all levels of Navy personnel and a bulletin written for instructor personnel. Twenty to twenty-three full pages selected at random were analyzed for each publication, using Flesch formulas to compute reading ease and human interest level of each of the eight publications. None of the eight publications were within the fourth grade reading level. The scores ranged from sixth grade to college level. Fourth

²⁸Allan H. Fisher, Army "New Standards" Personnel: Relationships Between Literacy Level and Indices of Military Performance, AFHRL (MD) Technical Report (April, 1971).

²⁹L. S. Standlee and N. A. Fattu, "Readability of Navy Publications," The Journal of Educational Research, IL (February, 1966), pp. 471-473.

grade reading ability has generally been accepted as "functional" literacy. This criterion has been used by the Census Bureau and by military literacy training programs. Present Navy literacy standards, for example, require that enlisted men be able to read at the fourth grade level before beginning recruit training. The study was designed to explore one aspect of the functionality of fourth grade reading ability; i.e., is fourth grade reading ability sufficient to enable an enlisted man to read the official publications that he will encounter in the Navy? This is of direct concern to the professional educator, for he has consistently been called upon to lend his talents to the preparation of military publications. It was concluded that fourth grade reading ability is not functional in the sense that it will enable an enlisted man who has achieved on this level of ability to read the eight Navy publications with ease.

The Gunning Fog Count is now being applied to all career development course manuscripts of the Air Training Command. As pointed out by Chall³⁰ and Klare³¹ low or high readability scores are not necessarily indications of good or bad writing. At best, they are a gross measure of the difficulty level of the written material and should be treated accordingly. A deliberate attempt on the part of the technical writer merely to reduce sentence length and

³⁰Chall, op. cit.

³¹Klare, op. cit.

word length to ensure a low Automated Readability Index will not necessarily enhance, and may degrade, readability. Obviously, there is no substitute for logical and concise writing.

Smith and Senter³² developed an automated Readability Index (ARI) for the Air Force using the Flesch formula. The number of strokes, number of words, and the number of sentences contained in the narrative were collected by a counter attached to an IBM Selectric typewriter during typing of the article.

During the development of this formula, 20-page samples were taken for all books involved. This provided data suitable for investigating the reliability of smaller sample sizes. Comparing the ratios obtained from one set of five sample pages, with another set of five from each of the 24 books used, resulted in an estimate of what the reliability would be if the Automated Readability Index were based on five-page samples. Increasing the sample size to ten pages resulted in reliability coefficients of .87 for word length, and of .95 for the overall index. These were judged to be adequate. There was no evidence to suggest that further lengthening of sample size would result in commensurate increases in reliability. An application of the formula assumes narrative material and not segmented material

³²E. A. Smith and R. J. Senter, Automated Readability Index. AMRL-TR-66-22, Wright-Patterson AFB, Ohio: Aerospace Medical Division, 1967.

such as checklists, operating instructions, etc. The prime reason for attempting to automate the data collection was to make it practical to take rather large samples.

Conclusions

The following concluding statements were developed from the review of related research:

The readability level of reading material may significantly affect the academic performance of a student.

The readability level of correspondence study material places the total task of interpretation on the student.

Armed Forces study materials may be written at a readability level higher than the mean reading ability of the enlisted men who are expected to use them.

CHAPTER III

RESEARCH DESIGN

Research Design

The descriptive-survey method of research was selected as most appropriate for solving this problem. Good described the descriptive-survey method as follows:

Descriptive studies may include present facts or current conditions concerning the nature of a group of persons, a number of objects, or a class or events, and may involve the procedures of induction, analysis, classification, enumeration, or measurement. The terms survey and status suggest the gathering of evidence relating to current conditions.¹

The Data

The data for this study will consist of test scores on three standardized tests for a sample of enlisted men in the U.S. Coast Guard. The data will also contain readability levels for correspondence study materials in each of fifteen subject areas ascertained through the use of the Gunning Fog and Dale-Chall readability formulas. The distribution and description of correspondence course readability

¹Carter V. Good, Introduction to Educational Research (New York: Appleton-Century-Crofts, Inc., 1959), p. 167.

levels is presented in narratives and tables.

Statistical analysis of the data will be accomplished through the use of the University of Oklahoma data processing services. Obtained mean scores and standard deviations for the scores on each of the three standardized tests was computed for the total sample. Correlation was used to test the relationships among the three standardized tests.

The Sample

The sample to be surveyed in this study was comprised of 320 enlisted men in the U.S. Coast Guard who entered the service since July 1, 1972. Enrollment accounting systems of the U.S. Coast Guard provided the enrollment data.

Correspondence course study materials for fifteen subject areas were assessed for their readability level using the Gunning Fog and the Dale-Chall readability indices. Completion of either the Fireman or Seaman materials is prerequisite to enrollment in any one of the thirteen subject areas reviewed.

FN	Fireman	E-3
SN	Seaman	E-3
AE2	Aviation Electrician, Second	E-5
AD2	Aviation Machinist, Second	E-5
BM2	Boatswain's Mate, Second	E-5
BT2	Boilerman, Second	E-5
CS2	Commissaryman, Second	E-5
SK2	Storekeeper, Second	E-5
ET2	Electronics Technician, Second	E-5
EN2	Engineman, Second	E-5
GM2	Gunner's Mate, Second	E-5
HM2	Hospital Corpsman, Second	E-5
QM2	Quartermaster, Second	E-5
RM2	Radioman, Second	E-5
YN	Yeoman, Second	E-5

Each set of Coast Guard correspondence course study material is made of seven to twelve pamphlets each containing 68 to 160 pages. The selected readability formulas will be assessed on page 23 of each of the first ten pamphlets. If the set of materials contains less than ten pamphlets, an additional sample was taken from the last pamphlet in the set on page 46 for each lesson backward from the last lesson until 10 samples have been taken. If the text is non-narrative on these pages, the sample was taken from the nearest previous page containing narrative material.

Instruments

Three standardized measurement instruments is used to gather data for the study. The California Achievement Test, Level IV Reading Subtest, Armed Forces Qualification Test and the General Classification Test are assumed to have been sufficiently validated to demonstrate their use and precision to assess reading level and academic ability. On the basis of published research which was cited in Chapter II, variations in reading ability and years of formal education should be reflected in the proportions of subjects exhibiting those variables measured by the three standardized instruments used. The Gunning Fog² and the Dale-Chall³

²Robert Gunning, The Technique of Clear Writing (New York, London, Toronto: McGraw-Hill Book Company, 1952).

³E. Dale and Jeanne S. Chall, "Formulae for Predicting Readability," Educational Research Bulletin, XXVII (January 21, 1947), pp. 11-20, 28.

formulas for ascertaining readability level were used to determine readability level of study materials in each of the subject areas.

The Dale-Chall formula for determining the readability of specified materials is intended to be a tool in selecting and preparing materials that can be understood by a specified audience, i.e. an audience that has a unique relationship with the reading material prepared in a narrative form.

"The formulas are based on two counts--average sentence length and percentage of unfamiliar words (words outside the Dale list of 3000 words)." Rules for selecting samples of a text to be analyzed and for computing the average sentence length and percentage of unfamiliar words may be found in Dale's⁴ article. As each count is made, it is recorded on a work sheet where steps are taken for arriving at the grade-level for reading difficulty. These steps are found in Dale.⁵

The aim of readability research has been to single out those factors of writing style that can be measured, and to take the added important step of finding out to what degree each affects reading difficulty. It has attempted to respond to the question, "How long can sentences be on the average before they discourage or derail the reader?"

⁴Ibid (Dale-Chall).

⁵Ibid (Dale).

Readability research has given answers to a number of other questions such as these: How rich a mixture of long, complex, hard, or abstract words will readers tolerate? What percentages of active verbs, concrete words, words referring to people are found in writing that has proved its acceptance with large audiences? And, most important of all, what level of sentence and word complexity do readers begin to balk? What in other words, is the danger line of reading difficulty?

In order to obtain some information to these and other questions regarding the readability level of U.S. Coast Guard correspondence materials, the Gunning-Fog Index was used in conjunction with the Dale-Chall technique. The following steps were used to arrive at the readability level of each of the fifteen sets of materials. These were taken from Gunning.⁶ The first step is to record the number of words in successive sentences. If the passage is long, one may select several samples of one hundred words. When this is done, stop the sentence count with the sentence which ends nearest the one hundredth word. Divide the total number of words in the passage by the number of sentences. This gives the average sentence length of the passage. Second: count the number of words of three syllables or more per one-hundred words. Do not count the words (1) that are capitalized (2) that are combinations of short easy words (like "bookkeeper"

⁶Ibid (Gunning).

and "manpower"), (3) that are verb forms made three syllables by adding -ed or -es (like "created" or "trespasses"). This gives the percentage of hard words in the passage. Third: to get the Fog index, total the two factors just counted and multiply by four tenths (0.4). (See Appendix A.)

Gunning⁷ in illustrating the Fog Index compares it with reading levels by grade and by magazine. He indicates that the danger line in terms of readability is a Fog Index rating of thirteen or higher which is equivalent to a college freshman reading level. He further indicates that the easy reading range has a Fog Index rating of ten or below. This is equated to a high school sophomore or lower.

Procedure

The records of the sample of three hundred and twenty enlisted men were screened for their scores on three standardized instruments, i.e. California Achievement Test Level IV, Reading Subtest, The Armed Forces Qualification Test, and the General Classification Test. The test scores were then compared to determine the relationship of the ability of the men to their reading level which was reflected in grade equivalency scores. These relationships will be expressed in "r" values obtained using the Pearson-Product moment correlation technique.

The readability level of each of the fifteen U.S.

⁷Ibid (Gunning), p. 38.

Coast Guard Correspondence course study materials will be assessed by using the Gunning-Fog and Dale-Chall techniques. The scores achieved by using each of the techniques will then be averaged together in order to arrive at more realistic grade level. In this manner most of the concerns expressed by each of the authors will be considered in arriving at a difficulty level which more realistically addresses itself to the writing style in the instructional materials. Each of the average U.S. Coast Guard correspondence course study materials readability scores shall be compared to the average reading level scores for the sample of three hundred and twenty in order to determine the extent to which U.S. Coast Guard personnel (as reflected in this sample) read at the same level at which the reading materials are written.

CHAPTER IV

RESULTS AND DISCUSSIONS

The statistical data and analysis are presented within the limitations imposed by the variables the instruments purport to assess. The sample of three-hundred and twenty men were randomly selected by the U.S. Coast Guard in July, 1972 from the new recruits which has enlisted at Cape May, New Jersey. All the men who had enlisted at that time and processed for active duty were assigned to companies; there were approximately eighty men assigned to each company. From sixteen companies, four were selected randomly. The Coast Guard enrollment accounting system provided all the test data used herein. The test data reflect assessments in the areas of reading, as measured by the California Achievement Test Level IV, Reading Subtest, the General Qualification Test and the Armed Forces Qualification Test.

The selection of materials to be used in the study was based on their representativeness and the likelihood that each man would be in a position to use them. The correspondence course study materials were selected for rate E-5. The materials for this rate were arbitrarily selected on the

basis that each enlistee (four-year period) will usually have the opportunity during his initial enrollment to make the E-5 rate and therefore, from a practical point of view, be dependent on the reading skills he has and the readability of the materials he must use in order to secure promotion or advancement. The materials which were used in this study to assess the readability levels of correspondence course study materials are reflective of the difficulty level of each of the other materials, according to the U.S. Coast Guard. There are ninety-four correspondence courses available for enlisted men in rates E-2 through E-9.

Table 1 shows the Pearson-Product Moment Correlation Matrix of three standardized instruments taken by the U.S. Coast Guardsmen (N=320). There appears to be a relatively high correlation among the three instruments. The highest relationship exists between the California Achievement Test (Reading Sub-Test), which assessed the reading level of Coast Guard personnel, and the General Classification Test, which assessed basic ability.

Table 2 shows the mean score and standard deviation of reading grade level of U.S. Coast Guard personnel and average mean readability grade level scores and average standard deviation of U.S. Coast Guard correspondence course study materials. Table 2 also shows the difference between the mean score of the U.S. Coast Guard personnel and each of the average mean readability grade level score of the U.S.

Coast Guard correspondence course study materials.

The data in Table 2 indicate that approximately thirty-three percent of the materials assessed indicated a different readability grade level in excess of three years over the mean reading grade level of the U.S. Coast Guard personnel. Approximately forty-seven percent of the materials assessed indicated a difference of readability grade level in excess of one year, but less than three years over the mean reading grade level of the U.S. Coast Guard personnel. The remainder showed less than a year's difference between the readability grade level of the materials and the mean reading level of the U.S. Coast Guard personnel.

Table 2 also indicates two E-3 rates and thirteen E-5 rates. The two E-3 rates are shown because they are necessary rungs in the ladder of promotion and successful completion of these correspondence course study materials is a prerequisite to enrollment in any other subject area. Therefore, successful completion of these materials is a matter of extreme importance to the U.S. Coast Guard and the men themselves. Table 2 indicates that the difference between the readability of the materials and the reading level of the men is approximately one year; i.e., the reading level of the men is about one year below the readability level of the materials.

Table 3 shows the means and standard deviation of a sample of U.S. Coast Guardsmen (N=320) scores on each of

three standardized instruments. The means for the Armed Forces Qualification Test and the General Classification Test are expressed in standard score units. The mean score for the California Achievement Test is expressed in mean reading grade level.

Table 4 shows the means, standard deviation and ranges of U.S. Coast Guard correspondence course study materials. The mean readability level, as determined by the Gunning Fog and the Dale-Chall instruments, is shown for each category of material. There appears to be a high relationship between the results of the two instruments. In most instances, the readability levels are very close. However, in order to utilize the results of both instruments in determining readability of the correspondence course materials, the means for each category were averaged together and then compared with the mean reading level of the U.S. Coast Guard personnel. This was reflected above in the discussion of Table 2.

The correspondence course study materials were assessed for readability using the Gunning Fog and Dale-Chall readability indices. Page twenty-three was arbitrarily chosen of each of ten pamphlets of each subject area material. However, if the set of materials contained less than ten pamphlets, an additional sample was taken from the last pamphlet in the set on page forty-six for each lesson backward from the last lesson until ten samples had been taken.

This technique attempted to assure randomness to the selection of narrative material which was assessed.

Tables 5 through 19 show the Dale-Chall and Gunning Fog analysis of U.S. Coast Guard correspondence course study materials for each of the fifteen rates which were assessed. The technique for analysis of these materials may be generally described in the following manner (the application would be appropriate for any of the other U.S. Coast Guard Course Study Materials) by examining Table 5: The first ten pamphlets available in this set of materials are identified as study material numbers 2,3,5,6,7,8,9,10,11,12. As indicated previously, page twenty-three in each set has been selected, with the exception of study material numbers 5,6,9 and 12. On these, page twenty-two was selected because there was nonnarrative material on page twenty-three and, therefore, the assessed material must be chosen from the nearest previous page containing narrative material. A paragraph on the narrative page is selected and identified by number. Then the total number of words in successive sentences is identified for each paragraph on each page of the material being examined. Then the total number of sentences is identified together with the average number of words per sentence. For example, in study material number 2, page 23, paragraph 2 had a total of 97 words in 6 sentences, with an average of 16.2 words per sentence. Factor one is arrived at. The words of three syllables or more are then

counted in the paragraph. The total number of three or more syllable words is divided by the total number of words in the paragraph. Factor two is arrived at. By adding the two factors together and multiplying by a constant of four-tenths (.4) will indicate that this reading material is written at the 12.2 grade level (as indicated in Table 5).

TABLE 1

PEARSON-PRODUCT MOMENT CORRELATION MATRIX OF THREE STANDARDIZED
INSTRUMENTS TAKEN BY U.S. COAST GUARDSMEN (N=320)

	California Achievement Test (Reading Subtest)	Armed Forces Qualification Test	General Classification Test
California Achievement Test (Reading Subtest)	1.00	0.43	0.74
Armed Forces Qualification Test	0.43	1.00	0.48
General Classification Test	0.74	0.48	1.00

TABLE 2

MEAN SCORE AND STANDARD DEVIATION OF READING GRADE LEVEL OF
U.S. COAST GUARD PERSONNEL AND AVERAGE MEAN READABILITY
GRADE LEVEL SCORES AND AVERAGE DEVIATIONS OF U.S.
COAST GUARD CORRESPONDENCE COURSE
STUDY MATERIALS

Category	$\bar{X}$	S.D.	Difference between Reading Level of Personnel & Readability of Materials
U.S. Coast Guard Personnel	11.29*	2.15	
Fireman, E-3	12.30*	2.43	+1.01**
Seaman, E-3	12.05	2.90	+0.76
Aviation Electrician, E-5	13.15	1.88	+1.86
Aviation Machinist, E-5	11.80	2.76	+0.51
Boatswain's Mate, E-5	13.10	3.23	+1.81
Boilerman, E-5	13.10	3.20	+1.81
Commissaryman, E-5	12.95	4.12	+1.66
Storekeeper, E-5	14.95	2.81	+3.76
Electronics Technician, E-5	14.35	2.48	+3.06
Engineman, E-5	12.25	2.59	+0.96
Gunner's Mate, E-5	13.00	2.02	+1.71
Hospital Corpsman, E-5	14.90	2.32	+3.61
Quartermaster, E-5	14.50	3.29	+3.21
Radioman, E-5	13.74	2.30	+2.45
Yeoman, E-5	15.65	1.83	+4.36

*Expressed in years and months.

**"+" indicates readability level higher than reading level expressed in years and months.

TABLE 3

MEANS AND STANDARD DEVIATIONS OF A SAMPLE OF U.S. COAST GUARDSMEN
(N=320) SCORES ON EACH OF THREE STANDARDIZED INSTRUMENTS

	Mean	Standard Deviations
California Achievement Test (Reading Subtest)	11.29	2.15
Armed Forces Qualification Test	60.00	17.78
General Classification Test	55.79	10.64

TABLE 4

MEANS, STANDARD DEVIATIONS, AND RANGES OF U.S. COAST GUARD
CORRESPONDENCE COURSE STUDY MATERIALS

U.S. Coast Guard Category	Gunning Fog Readability Level			Dale-Chall Readability Level		
	$\bar{X}$	S.D.	Range	$\bar{X}$	S.D.	Range
Fireman, E-3	12.5	2.54	7.9--17.0	12.1	2.32	7.4--15.9
Seaman, E-3	12.3	3.40	6.6--15.4	11.8	2.39	7.2--14.0
Aviation Electrician, E-5	13.4	1.96	10.0--17.2	12.9	1.79	9.8--16.1
Aviation Machinist, E-5	11.9	2.43	8.2--15.6	11.7	2.09	8.2--14.8
Boatswain's Mate, E-5	13.6	3.93	7.8--20.6	12.6	2.52	8.1--16.0
Boilerman, E-5	13.6	3.30	9.8--20.0	12.6	3.10	9.0--16.0
Commissaryman, E-5	13.3	5.01	7.8--26.7	12.6	3.23	8.1--20.0
Storekeeper, E-5	15.4	3.31	11.2--20.0	14.5	2.30	10.9--18.0
Electronics Technician, E-5	14.7	2.78	10.4--21.4	14.0	2.17	9.8--17.0
Engineman, E-5	12.3	2.63	8.3--16.0	12.2	2.55	7.4--15.7
Gunner's Mate, E-5	13.2	2.37	9.4--17.2	12.8	1.66	10.2--15.5
Hospital Corpsman, E-5	15.6	2.86	12.6--22.4	14.2	1.78	11.7--18.2
Quartermaster, E-5	15.0	3.63	7.7--20.0	14.0	2.94	8.1--17.2
Radioman, E-5	13.8	2.40	10.4--18.0	13.7	2.20	10.8--17.5
Yeoman, E-5	16.6	2.59	12.4--22.0	14.7	1.07	12.3--16.0

TABLE 5
U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
FIREMAN

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fog Index	Dale Chall
2	23	2	97	6	16.2	12.2	12.8
3	23	1	106	7	15.1	7.9	7.4
5	22	1	87	3	29.0	17.0	15.9
6	22	1	106	4	26.5	11.7	12.1
7	23	2	105	4	12.0	15.0	14.3
8	23	2	98	5	19.0	15.5	14.7
9	22	2	94	3	31.3	12.4	11.8
10	23	5	108	5	21.6	10.4	10.8
11	23	3	113	5	22.6	10.8	10.3
12	22	2	102	4	25.2	12.1	11.6
	$\bar{X}$	S.D.					
Dale-Chall	12.1	2.32					
Gunning Fog	12.5	2.54					

TABLE 6
U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
SEAMAN

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fog Index	Dale Chall
1	1-25	1	96	4	24.0	15.4	14.0
1	1-44	1	101	4	25.2	15.2	13.9
1	2-18	2	94	4	23.5	13.2	12.8
1	2-39	1	96	4	24.0	15.0	13.0
1	2-59	1-2	118	4	29.5	14.8	13.2
1	3-18	1-2	102	8	12.7	6.6	7.2
1	4-5	1	108	5	21.6	11.2	10.4
1	5-3	1	96	4	24.0	13.7	13.9
1	5-22	1	111	6	18.5	7.4	8.0
1	6-11	2	110	4	27.5	11.3	11.8
	$\bar{X}$	S.D.					
Dale-Chall	11.8	2.39					
Gunning Fog	12.3	3.04					

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TABLE 7

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
AVIATION ELECTRICIAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fog Index	Dale Chall
176	23	1-2	91	4	22.7	14.7	13.2
177	23	1-2	107	6	17.8	10.0	9.8
177	46	1-2	105	5	21.0	12.2	12.8
178	23	2-3	102	4	25.5	14.4	13.7
178	46	1-2	108	6	18.0	10.8	9.9
178	43	1	107	4	26.4	13.6	12.8
179	23	1	93	6	17.1	13.5	14.0
180	23	1	101	4	25.3	17.2	16.1
181	23	2	104	4	26.0	14.6	14.1
182	23	4	109	7	15.5	13.8	13.2
	$\bar{X}$	S.D.					
Dale-Chall	12.9	1.79					
Gunning Fog	13.4	1.96					

TABLE 8

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
AVIATION MACHINIST, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
256	22	1-2	110	5	22.0	12.8	11.9
328	23	1	109	6	18.1	10.1	10.6
328	46	2	100	6	16.6	8.2	8.8
329	23	1-2	104	5	20.8	12.5	11.8
329	46	2	108	5	21.6	14.2	13.6
329	69	2-3	108	4	27.0	15.6	14.8
330	23	2	102	7	14.5	8.9	8.2
331	23	1-2	93	5	18.6	11.3	12.0
332	23	3	118	5	23.6	15.2	14.6
333	23	2	107	6	19.0	10.7	11.2
	$\bar{X}$	S.D.					
Dale-Chall	11.7	2.09					
Gunning Fog	11.9	2.43					

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TABLE 9

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
BOATSWAIN'S MATE, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
189	22	1	101	4	25.0	12.3	13.2
190	22	1	95	3	31.6	20.6	16.0
190	47	1-2	119	4	29.7	15.3	14.2
191	23	2	113	6	18.8	11.7	12.2
192	23	1-2	99	6	16.5	9.0	9.6
194	23	2-3	103	5	20.6	10.9	10.2
195	23	1-3	120	4	30.0	19.0	16.0
196	22	1-3	95	5	19.0	16.0	14.2
418	23	2-3	108	5	21.6	14.2	12.9
419	22	2-3	107	5	11.2	7.8	8.1
$\bar{X}$ S.D.							
Dale-Chall	12.6	2.52					
Gunning Fog	13.6	3.93					

of

TABLE 10

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
BOILERMAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
M02110	23	1	113	4	28.2	18.3	16.0
M02110	46	1-2	117	3	39.0	20.0	15.8
M02110	69	1	109	6	18.1	9.8	10.2
M02110	92	2	117	5	23.4	11.8	9.8
10535-C	23	1	92	4	23.0	12.2	10.6
10535-C	47	1-2	111	5	22.2	13.5	14.0
10535-C	68	3	105	5	21.0	11.4	9.9
10535-C	92	2	106	3	35.3	15.2	13.6
10535-C	116	1-2	121	6	20.1	14.3	15.0
10535-C	138	2-3	103	6	17.1	9.9	9.0
	$\bar{X}$	S.D.					
Dale-Chall	12.6	3.10					
Gunning Fog	13.6	3.30					

TABLE 11

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
COMMISSARYMAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
169	22	2-3	101	2	51.0	26.7	20.0
169	43	2-3	100	4	25.0	13.2	12.9
169	69	1	109	4	27.2	10.6	11.2
170	23	1	100	6	16.6	7.8	8.1
170	46	2	99	6	16.5	8.2	8.6
170	69	1	105	6	17.5	11.4	10.5
171	23	2	102	4	25.5	15.2	14.0
171	45	4	102	4	25.5	13.7	13.2
171	69	1-2	126	5	25.2	13.8	14.4
171	93	2	101	6	16.8	12.6	12.9
	$\bar{X}$	S.D.					
Dale-Chall	12.6	3.23					
Gunning Fog	13.3	5.01					

TABLE 12

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
STOREKEEPER, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
115	23	1	115	4	28.7	14.9	14.8
115	49	1	118	6	19.6	11.2	10.9
114	23	1	91	5	18.2	11.6	12.1
442	21	6	111	5	22.2	14.0	13.5
442	47	1	119	3	39.6	18.2	16.1
443	25	2	97	3	32.2	19.8	18.0
444	23	2	103	4	25.9	13.8	14.1
444	46	3	100	5	20.0	20.0	18.0
445	23	1	114	5	22.8	12.2	12.5
445	46	1	125	4	31.2	19.2	16.0
	$\bar{X}$	S.D.					
Dale-Chall	14.5	2.30					
Gunning Fog	15.4	3.31					

TABLE 13

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
ELECTRONICS TECHNICIAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
67	23	3	101	5	20.2	10.4	11.3
73	23	2	104	5	20.8	17.5	17.0
90	23	3	118	5	23.6	14.5	14.2
227	22	2	96	5	19.2	16.0	15.2
228	23	1	107	5	21.4	10.4	9.8
229	23	4	122	5	24.4	18.2	16.0
230	21	4	132	2	66.0	17.6	16.0
231	23	3	105	3	34.6	16.8	15.1
232	23	4	116	7	16.5	21.4	13.7
233	20	7	107	5	21.4	13.8	12.7
	$\bar{X}$	S.D.					
Dale-Chall	14.0	2.17					
Gunning Fog	14.7	2.78					

TABLE 14

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
 ENGINEMAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
274	24	1	117	5	23.4	13.4	11.8
172	23	1	108	5	21.6	13.8	14.2
276	23	2	101	5	20.2	16.0	15.7
277	23	7	99	5	19.8	12.7	13.4
278	23	2	115	5	23.0	14.0	13.2
279	23	1	101	6	16.8	8.3	7.4
302	23	3	105	5	21.0	15.2	14.5
303	22	2	109	6	18.1	8.7	9.2
304	22	5	97	6	16.1	8.9	9.6
305	22	9	104	5	20.8	12.9	13.7
	$\bar{X}$	S.D.					
Dale-Chall	12.2	2.55					
Gunning Fog	12.3	2.63					

TABLE 15
U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
GUNNER'S MATE, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
68	24	2	100	4	25.0	15.6	15.1
359	23	4	120	5	24.0	12.9	12.3
356	23	1	106	7	15.1	9.4	10.2
360	23	2	123	5	24.6	14.0	13.6
358	23	1-2	94	4	23.5	14.0	13.2
362	23	1	104	4	26.0	10.2	10.2
357	23	1	120	8	15.0	10.6	11.1
357	41	1	108	5	21.6	15.0	13.8
361	28	3	100	7	14.2	13.2	12.7
361	46	1	95	5	19.0	17.2	15.5
	$\bar{X}$	S.D.					
Dale-Chall	12.8	1.66					
Gunning Fog	13.2	2.37					

TABLE 16

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
HOSPITAL CORPSMAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
172	23	5	105	6	17.5	13.8	14.4
172	41	4	117	5	23.4	13.1	12.3
172	77	6	97	4	24.3	14.2	13.5
173	25	1	125	3	41.6	22.4	18.2
173	41	1	98	5	19.6	16.4	14.9
173	51	1	107	5	21.4	14.1	13.5
174	21	1	98	4	24.5	12.6	11.7
174	41	6	102	4	25.5	18.0	15.3
175	24	3	99	5	19.8	17.6	15.7
175	41	1	100	4	25.0	14.0	13.1
	$\bar{X}$	S.D.					
Dale-Chall	14.2	1.78					
Gunning Fog	15.6	2.86					

TABLE 17

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
QUARTERMASTER, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
369	9	1	100	5	20	15.2	15.7
364	12	3	111	5	22.2	12.1	11.7
367	22	4	108	4	27.0	15.6	14.8
368	22	1-2	100	7	14.2	7.7	8.1
365	23	1	98	3	32.6	19.1	17.0
370	23	1	99	5	19.8	10.7	9.9
366	21	1	123	4	30.7	17.4	15.8
169	30	4	85	2	42.5	17.0	15.8
169	53	3	103	2	51.5	20.0	17.2
363	22	2	121	6	20.1	15.2	14.8
	$\bar{X}$	S.D.					
Dale-Chall	14.0	2.94					
Gunning Fog	15.0	3.63					

TABLE 18

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
RADIOMAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
14	23	1	97	4	24.2	16.2	15.5
15	23	1-2	103	5	20.6	12.9	12.2
17	21	5	100	4	25.0	16.0	15.7
18	23	1	101	5	20.2	10.4	11.3
19	23	1-5	112	5	22.4	10.7	11.0
20	23	3	105	5	21.0	11.4	10.8
21	22	5-6	112	5	22.4	13.6	14.0
22	23	1-2	108	6	18.0	14.6	15.2
23	22	1	113	5	22.6	15.0	14.7
24	27	1-3	96	5	19.2	18.0	17.5
	$\bar{X}$	S.D.					
Dale-Chall	13.7	2.20					
Gunning Fog	13.8	2.40					

TABLE 19

U.S. COAST GUARD CORRESPONDENCE COURSE STUDY MATERIAL FOR
YEOMAN, SECOND CLASS

Study Material Number	Page Number	Para- graph	Total Number of Words	Number of Sentences	Words per Sentences	Gunning Fox Index	Dale Chall
295	22	2	98	3	32.0	17.2	16.0
296	23	2	105	5	21.0	13.7	12.3
296	51	6	116	4	29.0	18.4	15.6
297	23	2	105	5	21.0	17.9	14.7
297	45	3	111	3	37.0	22.0	16.0
258	23	1	91	5	18.0	15.5	14.3
298	23	1	100	4	25.0	12.4	13.7
299	23	1	116	5	23.2	14.8	15.3
300	23	1	117	4	29.1	18.1	14.8
301	25	1	96	4	24.0	16.6	14.4
	$\bar{X}$	S.D.					
Dale-Chall	14.7	1.07					
Gunning Fog	16.6	2.59					

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A summary of the study, the conclusions, and the recommendations are presented in this chapter to clarify the study.

Summary

This study investigated the problems of determining the readability level of the U.S. Coast Guard Institute correspondence study material in fifteen subject areas and determining the mean reading level of a sample of enlisted personnel as measured by the California Achievement Test, Level IV, reading subtest.

The purpose of the study was to indicate any differences between the reading level of the U.S. Coast Guard enlisted personnel and the mean readability level of the correspondence course study materials.

The specific null hypotheses tested in this investigation were stated as follows:

1. There is no statistically significant relationship between the obtained scores on the Armed Forces

Qualification Test and the obtained scores on the California Achievement Test, Level IV.

2. There is no statistically significant relationship between the obtained scores for the sample on the Armed Forces Qualification Test and the obtained scores for the sample on the General Classification Test.

In order to conduct this study, the Gunning Fog and Dale-Chall readability assessment techniques were employed. The California Achievement Test, Level IV, Reading Subtest was used to measure the mean reading level of the sample of enlisted personnel for this study.

The methodology for conducting this study consisted of randomly selecting three hundred and twenty enlisted men whose records were available from the U.S. Coast Guard Institute. The following procedures were followed:

1. A comprehensive review of the related research was made to establish basic assumptions for the study.

2. Three standardized instruments designed to assume reading abilities and general academic ability were selected. These measurement instruments were the California Achievement Test, Level IV, Reading Subtest, Armed Forces Qualification Test, and the General Classification Test.

3. Arrangements were completed to obtain all necessary data from the U.S. Coast Guard.

4. A sample of fifteen enlisted men's correspondence courses were selected for assessment from a total of

ninety-four courses offered by the U.S. Coast Guard Institute.

5. Each correspondence course text was assessed ten times by the Gunning Fog and ten times by the Dale-Chall readability formulas. The formulas were applied to the sampling techniques.

6. The Pearson-Product Moment Correlation Matrix, Mean Score, and Standard Deviation statistical formulas were used to analyse the standardized test data using data processing equipment at the University of Oklahoma.

An enlisted man is trained in one of the Coast Guard specialties through various means. He may receive training at a Class A school or be involved in on-the-job training. Regardless of the method of training, advancement to the E-5 pay grade requires successful completion of the E-5 correspondence course. Although selection for training in a particular speciality is based on General Classification Test scores, advancement in all specialties depends on successful completion of correspondence courses. The Seaman or Fireman course is the basic correspondence course for advancement to pay grade E-3. The successful completion of one of these correspondence courses is a prerequisite to enrollment in any other subject area. The U.S. Coast Guard has very little control over an enlisted man's reading level at the time of his entering the service. Generally, the Armed Forces study materials are written at a readability level

higher than the mean reading ability of the enlisted men who are expected to use them.

This study was limited to enlisted men in the U.S. Coast Guard who entered service after July 1, 1972, and have graduated from basic training.

Conclusions

The conclusions of this study are based on the general findings inferred from this study.

The specific null hypotheses tested resulted in the following findings and conclusions:

The findings. The Pearson-Product Moment Correlation Matrix of the California Achievement Test, Level IV, the Armed Forces Qualification Test, and the General Classification Test indicates a relatively high correlation among the three instruments. The highest relationship exists between the California Achievement Test, Level IV, which assessed the reading level of Coast Guard personnel, and the General Classification Test, which assessed basic ability.

The conclusion. The California Achievement Test, Level IV, Armed Forces Qualification Test, and the General Classification Test are assumed to have been sufficiently validated to demonstrate their use and precision to assess reading level and academic ability.

It was concluded from an examination of the overall results obtained in this investigation that:

1. The mean reading level of the U.S. Coast Guard

sample of 320 men is approximately the eleventh grade. Approximately eighty percent of the reading material had a readability grade level in excess of grade twelve which according to the Fog Index is a danger line and approaches the college freshman reading level.

2. Each of the fifteen U.S. Coast Guard correspondence courses selected for this study indicated a readability grade level higher than the mean reading level of the U.S. Coast Guard personnel selected for this study. The danger line concept of the readability of the material is a significant indication that some serious reading problems may arise for U.S. Coast Guard personnel who must read these materials in order to achieve promotion or other types of merit increases.

3. Although the Seaman and Fireman correspondence courses rank nearer the mean reading level of the 320 U.S. Coast Guard personnel selected than most of the other courses selected, their readability grade level may be the initial obstacle in the path of advancement.

4. The readability grade level for the thirteen E-5 courses used in this study range from 11.80 to 15.65. This results in approximately a four year difference in the readability grade level between the course with the lowest grade level and the course with the highest grade level. A range in readability level of courses is acceptable since a difference in general ability is established by General

Classification Test scores prior to placement in a particular speciality. However, the difference between the mean reading level of 11.29 and the average readability grade level of the thirteen speciality courses, which is 13.65, is significantly high.

Recommendations

As a result of the data obtained in this study it is recommended that:

1. Careful consideration should be given to a major revision of U.S. Coast Guard correspondence courses to reduce their readability grade level. The readability level established should be such that those with average or slightly below average reading ability would experience little, if any, difficulty in comprehension.

2. Further study should be conducted to determine the feasibility of upgrading the reading level of U.S. Coast Guard personnel during their first enlistment since raising the standards for enlistment is not practical during this period of manpower shortage and suspension of selective service. If the U.S. Coast Guard would chose to improve the reading level of personnel, consideration must be given to the effect delay in advancement would have upon the personnel since advancement is an incentive for satisfactory performance at assigned task in the Coast Guard as well as an inducement to re-enlist.

3. Steps should be taken to adjust either the

readability level of the materials or the reading level of the personnel. The readability level of the Fireman and Seaman correspondence courses should be reduced to a point equal or below the mean reading level of 11.29 indicated by this study as that of U.S. Coast Guard personnel upon initial enlistment since the short period which exist between the time a man enlists in the U.S. Coast Guard and the time when he begins his first correspondence course does not allow sufficient time for upgrading his reading level.

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APPENDIX A

GUNNING FOG INDEX OF READABILITY

Step I

Take a sample of 100 words. Get as close to 100 words as possible. Divide the number of sentences into the number of words.

Step II

Count the number of three syllable words in the sample passage with the following exceptions:

- a) Do not count proper names
- b) Compound words
- c) Any verb forms

Step III

Get the percentage of the three syllable words obtained by the following formula:

Take the number of words divided into the number of three syllable words. This will give you a factor. Use the average sentence length found in Step I and this will give you a second factor.

Step IV

Add the factors and then multiply by the constant .4 which will give you a grade level.

APPENDIX B

DALE-CHALL--A FORMULA FOR PREDICTING READABILITY

1. Number of words in the sample.	_____
2. Number of sentences in the sample.	_____
3. Number of words not in Dale List	_____
4. Average sentence length (divide 1 by 2).	_____
5. Dale score (divide 3 by 1, multiply by 100). . .	_____
6. Multiply average sentence length (4) by .0496. .	_____
7. Multiply Dale score (5) by .1579	_____
8. Constant	_____
9. Formula raw score (add 6, 7, and 8).	_____
Average raw score of _____ samples	_____
Average corrected grade-level.	_____

Correction Table

Formula Raw Score	Corrected Grade Levels
4.9 and below . .	4th grade and below
5.0 to 5.9. . . .	5-6th grade
6.0 to 6.9. . . .	7-8th grade
7.0 to 7.9. . . .	9-10th grade
8.0 to 8.9. . . .	11-12th grade
9.0 to 9.9. . . .	13-15th grade (college)
10.0 and above. .	16 (college graduate)