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ABSTRACT

READNEED research was concerned with the development of methodologies for determining reading requirements of Army Military Occupational Specialties (MOSs). Three approaches for assessing MOS literacy demands are described: (a) analysis of readability of Army MOS materials using a newly developed readability formula calibrated on Army personnel and Army job materials; (b) use of information currently in Army data banks to study relationships between reading ability (estimated from AFQT) and job proficiency (indexed by the Primary Military Occupational Specialty/Evaluation Test); and (c) direct assessment of personnel reading skills in relation to proficiency on specially constructed Job Reading Task Tests (JRTT). Feasibility studies that indicate the relative merits of each approach, and certain conceptual and operational problems in determining literacy requirements of jobs are described. (Author)

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Methodologies for Determining Reading Requirements of Military Occupational Specialties

John S. Caylor, Thomas G. Sticht, Lynn C. Fox, and J. Patrick Ford

HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street • Alexandria, Virginia 22314

March 1973

Prepared for:
Office of the Chief of Research and Development
Department of the Army
Washington, D.C. 20310

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1. The purpose of this report was to continue development of approaches to determining reading requirements in military jobs, following on related research under Work Unit REALISTIC. The feasibility of a general methodology for determining literacy demands of Army jobs was assessed by means other than expensive, large-scale job-knowledge and job-sample performance testing.

2. Three approaches for assessing Army job reading demands are studied: (a) determining reading grade level of difficulty of MOS printed material; (b) developing a formula for estimating reading grade level of ability from the AFQT, and determining a correlation between estimated reading ability and job proficiency; (c) correlating personnel reading skills with Job Reading Task Tests proficiency for three MOSs. It was concluded that remedial literacy training should be aimed at producing no less than grade 7.0 reading ability, and that job reading requirements for any MOS can be established on the basis of existing Army Personnel data (AFQT and MOS/ET). The FORCAST readability formula that was developed provides a valid estimate of the reading difficulty of Army technical reading material, and can be used as a quality-control device for simplifying reading material to match reading ability levels.

3. Personnel who will be interested in this report include researchers and instructors in training methods, functional literacy, readability analyses, and job proficiency.

FOR THE CHIEF OF RESEARCH AND DEVELOPMENT:

R. O. VITERNA
Colonel, GS

HumRRO
Technical
Report
73-5

Methodologies for Determining Reading Requirements of Military Occupational Specialties

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HUMAN RESOURCES RESEARCH ORGANIZATION

Work Unit READNEED

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The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development, and consultation. HumRRO's mission in work performed under contract with the Department of the Army is to conduct research in the fields of training, motivation, and leadership.

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FOREWORD

Work Unit READNEED was undertaken by the Human Resources Research Organization in order to provide information about methodologies for determining literacy demands of Army jobs. This report presents information on three different approaches that may be useful in determining how well personnel must be able to read in order to do a job. Related research is discussed in reports from HumRRO Work Unit REALISTIC.

The research was conducted at HumRRO Division No. 3 Presidio of Monterey, California, where Dr. Howard H. McFann is Director.

Military support was provided by the U.S. Army Training Center Human Research Unit, Presidio of Monterey, Col. Ulbert Hermann, Chief.

The research was performed by Dr. John S. Caylor, Dr. Thomas G. Sticht, Mr. Lynn C. Fox, and SP5 J. Patrick Ford, with assistance by Mr. William E. Burckhartt and Mrs. Nina McGiveran. Military assistants from the Human Research Unit were SP4 D. Enderby, SFC Steven Snyder, and SP4 James McMasters.

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Meredith P. Crawford
President
Human Resources Research Organization

SUMMARY AND CONCLUSIONS

MILITARY PROBLEM

Major mobilization of manpower resources is generally accompanied by an influx into the Armed Services of men with marginal literacy skills. In order to make best use of these men, they must be classified into jobs for which their limited reading skills will suffice, or they must be given remedial literacy training to raise their reading skill levels to meet the job requirements. In either case, knowledge of the reading demands of jobs is necessary for the most effective action.

RESEARCH PROBLEM

The purpose of Work Unit READNEED was to study methodologies for determining the reading requirements of jobs. This research follows HumRRO Work Unit REALISTIC (1), in which reading requirements of four major military occupational specialties were determined. In READNEED, certain of the approaches used in REALISTIC were to be refined, and the feasibility of a general methodology for determining literacy demands of jobs using current Army personnel files was to be tested without the expense of the large-scale job-knowledge and job-sample performance testing used in REALISTIC.

METHOD

Three approaches for assessing MOS reading demands were studied:

(1) A determination of the reading grade level of difficulty of MOS printed materials using a readability formula especially designed and calibrated for use with Army personnel and Army job materials.

(2) The development and use of a formula for estimating reading grade level of ability from the Armed Forces Qualification Test (AFQT), and a determination of the correlation between estimated reading ability and job proficiency indexed by the Primary Military Occupational Specialty/Evaluation Test (MOS/ET) and Enlisted Efficiency Rating (EER). All these scores can be obtained from present Army data banks.

(3) The correlations of personnel reading skills with proficiency on Job Reading Task Tests (JRTT) developed in REALISTIC for the Cook (MOS 94B), Unit and Organizational Supply Clerk (MOS 76Y), and Wheel Vehicle Repairman (MOS 63C) MOSs. The effects of selection and of selection plus Combat Support Training (CST) on this correlation were evaluated by comparing the correlations of men tested at the Reception Station at Fort Ord, with those of men selected for CST in the appropriate MOS but not yet trained (Pre-CST group), and of men *both* selected *and* trained (Post-CST) in the appropriate MOS.

RESULTS

The research on readability provided the following results:

(1) The production of a simple, easy-to-administer formula for validly estimating the reading grade level of difficulty of Army job reading materials, based solely upon a count of the number of one-syllable words in a 150-word sample of the material.

This formula was named the FORCAST (*FOR*d, *CA*ylor, *ST*icht) formula, following the usual practice in readability research.

Information about the correlations among the Flesch, Dale-Chall, and FORCAST readability formulas indicated that, although estimates of reading difficulty of materials based on these formulas are highly correlated and of similar validity, the simplified FORCAST formula produced a more accurate estimate of the reading difficulty of Army MOS passages.

(2) Information which indicated that more than half the reading materials in each of seven MOSs exceeded the grade 11.0 level of difficulty as estimated by use of the FORCAST formula.

The research on the feasibility of using information in present Army data files to estimate the reading demands of Army MOSs produced these findings:

(1) Reading grade level (RGL) and AFQT are highly correlated (*rs* ranging from .68 to .79). Hence the RGL may be estimated from AFQT scores with moderately high accuracy.

(2) AFQT and job proficiency indexed by the Enlisted Efficiency Report (EER), a rating made by supervisors, were not related. Therefore, the EER cannot be used to estimate reading demands of jobs. This finding confirms previous observations on the relationships between supervisors' ratings and AFQT, reading ability, job knowledge, and job sample performance. Thus the EER shows no useful relationship to literacy or to the measurable components of job proficiency mediated by reading.

(3) AFQT and the Primary Military Occupational Specialty/Enlisted Evaluation Test (MOS/ET) were directly and significantly related, indicating the feasibility of estimating the RGL requirements of MOSs on the basis of relationships among reading test scores, AFQT, and MOS/ET.

(4) RGL scores associated with proponent-established proficiency cut-off scores for the MOS/ET for seven MOSs indicated that minimal passing scores set by the proponent agencies in two MOSs were too low to estimate reading requirements using this method; for five MOSs, the reading requirements so estimated ranged from grade levels 7 through 9.

(5) Increasing the median, minimal passing MOS/ET cut-off scores eight points—from 57 (46%) points correct to 65 (52%) points correct—for seven MOSs, resulted in a two-year increase in median estimated RGL, from grade 9.8 to grade 11.9. This indicated that these MOS tests measure with great sensitivity in this midrange of scores.

Research on Job Reading Task Tests (JRTT) indicated that:

(1) The JRTT and standardized reading tests results were highly correlated, suggesting that these tests may be viewed as being equally valid, alternative measures of general reading ability. Test-retest reliabilities for the JRTT were in the range from .74 to .85—acceptable reliability (stability) of scores on these experimental instruments. Intercorrelations among the subtests of each JRTT with the sum of the remaining subtests in each JRTT were generally moderately high and positive, implying that each subtest cannot be considered a measure of a separate, independent reading skill.

(2) Combat Support Training in the MOS for which a JRTT was designed improved performance on the JRTT for men of all reading levels from the 5th to the 14th grade, although the greatest improvement was observed in the performance of men with poorer reading ability.

(3) In the Repairman's MOS (63C) and Supply Clerk's MOS (76Y), selection for training in the MOS on the basis of classification test scores was associated with improved performance on the JRTT for these MOSs; this was not true for the Cook's MOS (94B).

(4) Correlations of JRTT, standardized reading tests, and AFQT with Post-CST academic grades ranged from a low of .49 to a high of .72. All instruments were equally effective as predictors of achievement in the MOS/CST program.

(5) For the Cook and Repairman MOSs, JRTT and AFQT scores were significantly correlated with Post-CST performance on a job-knowledge, paper-and-pencil test designed in HumRRO Work Unit UTILITY to assess a job incumbent's knowledge of essential job information. Similar correlations obtained for Pre-CST men in the Cook MOS indicate that performance on the job-knowledge tests reflects, to a large degree, a man's reading ability rather than his job knowledge. The man who reads better presumably learns more and, therefore, scores higher on the job-knowledge test.

(6) The use of a decision rule stating that 80% of the Post-CST men at a reading level should get 70% correct on the JRTT for their MOS suggests that the minimum literacy requirement for Repairmen and Cooks would be grade 7.0, but 10th grade ability would be needed for Supply Clerks.

CONCLUSIONS

(1) Although no single level of functional literacy can adequately represent the reading requirements of the range of MOSs studied, there appears to be a lower limit of grade 7.0 for functional literacy in the Army. Almost no job reading passages were found at or below this level in the reading materials prescribed for a representative range of seven high-density, but diverse MOSs nor with minor exceptions, was the reading requirement for any of 10 MOSs[1] established below this level by any of the procedures studied. Hence, remedial literacy training should be aimed at producing *no less than* seventh grade reading ability, and, optimally, should be targeted to the level of a man's MOS assignment.[2]

(2) Job reading requirements for any MOS can be established efficiently and routinely on the basis of existing Army personnel data (AFQT and MOS/ET) with nominal effort and cost. Although reading ability is not usually assessed, the stable and substantial relationship ($r \cong .7$) between AFQT and reading permits the estimation of the latter without additional testing.

(3) Job reading materials are, for the most part, so difficult to use that they are ignored by most of the intended users. The easy-to-use FORCAST readability formula provides a valid estimate of the reading difficulty of Army technical reading material for the Army population, and can be used as a quality-control device for the simplification of reading material to match the reading ability levels of the users.

[1] Three additional MOSs were added in order to assess the relationships between reading ability established by standardized, grade-school referenced tests and performance on Job Reading Task Tests.

[2] Current HumRRO Work Unit FLIT has as its objective the development of an experimental Army literacy training program designed to achieve seventh grade reading level.

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Methodologies for Determining Reading Requirements of Military Occupational Specialties

Chapter 1

INTRODUCTION

Rapid technological advances place a premium upon fundamental information processing skills, especially language and literacy skills. If a technologically based organization, such as the modern Army, is to survive and function effectively and efficiently, it must have personnel whose literacy skills match the literacy requirements of the jobs within the organization.

Although the Army has continually encountered the problems produced by the scarcity of academically qualified manpower, these problems recently have been increased by the introduction, under Project 100,000, of large numbers of men whose reading skills fall substantially below the functional literacy levels of major military occupational specialties (MOS) (1). Furthermore, it is anticipated that, as the Army moves toward an all-volunteer force, a significant proportion of the manpower will have to be drawn from the pool of less academically qualified workers.

Facing these problems directly, the Army has sponsored research by the Human Resources Research Organization to develop methodologies for determining the literacy requirements of Army MOSs (HumRRO Work Units REALISTIC and READNEED) and to develop a prototype literacy training program geared to produce MOS-related functional-literacy skills (HumRRO Work Unit FLIT).

The present report describes research performed in Work Unit READNEED, which was directed toward (a) the refinement of methods used in the REALISTIC research to establish literacy requirements of jobs, and (b) to develop more general, less expensive methods.

The REALISTIC effort used three different methods to identify reading demands of a small number of jobs. One method involved the identification of reading materials in five Army MOSs, and an evaluation of the average reading difficulty level of these materials using the modified Flesch readability formula of Farr, Jenkins, and Patterson (2). This method, its limitations, and its refinement under READNEED are discussed in Chapter 2 of this report.

The second approach used in REALISTIC to evaluate reading requirements of Army MOSs involved the measurement of literacy skills of some 400 men in each of four MOSs having a high-density input of low-aptitude men. These men were also tested on job-knowledge tests and four- to five-hour job-sample tests, in which cooks cooked, vehicle mechanics repaired vehicles, supply clerks filled out forms, and armor crewmen operated the tank and its weapons systems. Relationships between literacy test performance and job knowledge and job performance were then studied to establish literacy-skill levels associated with the various levels of proficiency on the job tests. While this approach yields a great deal of information, it is extremely time consuming and expensive, and is not feasible as a general approach to establishing reading requirements for the hundreds of Army military occupational specialties in existence. Chapter 3 of this report describes an alternative approach to identifying reading-skill levels associated with successful job proficiency, using data currently maintained in Army personnel files.

In the final approach used in REALISTIC for establishing reading demands of MOSs, a detailed determination was made, by means of on-site interviews, of the job-specific reading materials actually used by job incumbents in three MOSs. For each of these

MOSs, a Job Reading Task Test was constructed from these source materials, yielding tests consisting of reading material used by men in performing their jobs. As a final research activity under REALISTIC, Job Reading Task Test performance was studied in relationship to conventional school reading measures and the AFQT. As a product of this effort, the Army was provided with (a) reading tests composed of the actual job reading materials in three MOSs, and (b) information on the relationships between performance on Job Reading Task Tests, general educational reading-grade level, and AFQT for men new to the Ar[illegible]o were tested at the reception station at Fort Ord.

[illegible] provides a means of identifying the general reading levels associated w[illegible]ous criterion levels of proficiency on the Job Reading Task Tests; that is, the reading demands of a job can be stated in terms of how well a man needs to read (in grade school scores) in order to read job printed materials with varying degrees of proficiency. Like the second approach mentioned earlier, the determination of job reading requirements by testing men on job reading task tests is an expensive undertaking, and realistically could not be undertaken for each Army job. Nonetheless, such a procedure is the most direct method for determining *reading* demands of a job, and might feasibly be employed in conjunction with job *clusters*, using reading task tests constructed to represent the most frequently occurring types of reading in the cluster. Because of the potential of the Job Reading Task Test methodology, psychometric data in addition to that collected in the REALISTIC research were obtained in READNEED. These data, concerning the reliability of Job Reading Task measures, and the influence of selection for and training in the MOS represented by the Job Reading Task Test, are presented in Chapter 4 of this report.

Finally, Chapter 5 presents a general summary and a statement of conclusions regarding the problem of determining the literacy requirements of jobs.

Chapter 2

DEVELOPMENT OF THE FORCAST READABILITY FORMULA FOR ARMY TECHNICAL MATERIALS

ESTIMATING READABILITY

READABILITY FORMULAS

For many years, various formulas for estimating the readability of printed materials—that is, how easy they are to read and understand—have been available (3). Generally speaking, indices of readability are established by following three basic steps.

(1) A number of structural factors, such as the average sentence length, number of syllables per word, and number of words occurring with low frequencies in general English usage, are identified.
(2) The number of occurrences of such factors in selected reading passages is correlated with performance on comprehension tests based on the passages.
(3) Formulas (multiple regression equations) are derived that state the functional relationships between the structural factors and performance on the comprehension tests.

For the average reader, a low readability score predicts a low level of comprehension of the passage, while a high score predicts a high level of comprehension. Sometimes this procedure is extended so that a formula will estimate the school grade level of students who reach a specified criterion level in answering comprehension questions after having read the passage. It is possible, in this case, to state the reading grade level of difficulty of a publication.

There have been several applications of readability analyses to military publications, with the objective of stating the reading levels needed to understand the materials (3, 4, and 5). In Work Unit REALISTIC, a modification of a formual devised by Flesch in 1948 (1, 4) was used to assess reading difficulty of Army publications. The formula follows:

Readability = (1.599 x the number of one-syllable words per 100 words)—(1.015 x the average number of words in the sentences)—31.517.

This modified formula correlates better than .90 with Flesch's 1948 formula. The latter, in turn, has a validity coefficient of .70 for predicting the reading grade placement at which 75% comprehension of 100-word samples of the McCall-Crabbs *Standard Test Lessons* will occur (3, pp. 56-59). The raw-score index numbers derived with the use of the above formula have a range from 0 to 100 for almost all samples taken from ordinary prose. A score of 100 corresponds to the prediction that a child who has completed fourth grade will be able to answer correctly three-quarters of the test questions about the passage that is being rated. In other words, a score of 100 indicates reading matter that is understandable for persons who have completed fourth grade and are, in the language of the U.S. Census, barely "functionally literate" (6, p. 225). In the REALISTIC research, the raw-score indices obtained with the Flesch formula were converted directly into school grade equivalents by means of a specially prepared table (5).[1]

[1] The Dale-Chall Readability formula was applied to a subset of these materials, and the results are described in 5.

The major usefulness of an appropriate readability index is that it permits an immediate estimation of the reading ability level required to understand a passage, making use of clerical operations without the need for further testing. A readability index may be applied (a) to specific *draft material* in preparation in order to gauge its comprehensibility for its intended audience, and (b) to samples of the job reading material in an MOS (as in the REALISTIC research) in order to determine the reading ability required to understand the job materials. Given an appropriate formula, all that is needed is the reading material, the readability definitions and formula, and a clerk competent to apply it.

LIMITATIONS TO USING AVAILABLE FORMULAS WITH ARMY MATERIALS

Several problems arise in applying existing readability formulas to Army job reading material. General readability formulas have been developed on and for the public school population; it is not known how appropriate these indices may be for the young adult male Army reading population and for Army job reading material, with its characteristic style, format, and heavy use of technical nomenclature. However, the fact that the formulas have validity coefficients of about .70 for predicting the performance of *school children* on reading comprehension tests indicates that they account for roughly 50% of the variability in reading performance of *children*. It is likely that they may account for less variability in *adult* performance, especially since material containing large numbers of technical terms would increase the estimate of difficulty made by the readability formulas.

An additional drawback to the use of general readability formulas with Army technical material is that some indices require special grammatical or linguistic competence on the part of the user, or the use of special word lists or equipment that is not likely to be routinely and readily available to the general user.

PROCEDURES USED IN DEVELOPING THE FORCAST READABILITY FORMULA

Although available readability formulas have serious limitations for application to Army technical materials, the general approach to determining the reading skill level requirements of job printed materials by use of a readability index provides a relatively fast, inexpensive, and objective estimate of these requirements. Accordingly, the READNEED staff undertook development of a readability index that would be (a) based on essential Army job reading material, (b) normed for the young adult male Army recruit population, and (c) simple and readily applicable by standard clerical personnel without special training or equipment. The formula that was developed to these specifications has been designated the FORCAST Readability formula.

The major steps in developing the FORCAST readability index for job reading materials included:

(1) Determination of jobs (MOSs) to be included.
(2) Determination of essential job reading materials.
(3) Selection of reading passages from the job reading materials, and assessment of appropriate structural properties.
(4) Measurement of an individual reader's comprehension of passages from the job reading materials.
(5) Scaling of passages in terms of the reading grade level (RGL) required for a designated criterion level of comprehension.

(6) Determination of optimal weights of the structural properties of passages in order to maximize the prediction of RGL required to comprehend the passage at the designated criterion level.

Within this general framework, many specific decisions made in carrying out the general procedures had an effect on the outcome; these decisions are discussed in detail.

SELECTION OF MOSs AND ESSENTIAL JOB READING MATERIALS

In developing the FORCAST readability index, essential job reading materials were collected for seven MOSs:

11B20 Light Weapons Infantryman
26D20 Ground Control Radar Repairman
63B20 Wheel Vehicle Mechanic
71H20 Personnel Specialist
76Y20 Armorer/Unit Supply Specialist
91B20 Medical Specialist
95B20 Military Policeman

These MOSs were selected to provide information on high-density jobs over a wide range of job families and content areas.

The determination of what body of reading material is essential and integral to a job is frequently an arbitrary one. In READNEED, the definition of reading material essential to job performance was less so because the DA Pamphlet 12- Series prescribes the source reading material on which the mandatory annual Primary MOS Enlisted Evaluation Test is based. For each MOS, the test study guide provides authoritative specification, to the chapter level, of the source materials which a job incumbent must know to validate or maintain his job classification. These materials may be considered as essential job reading materials, because they form the basic depository of knowledge that a man needs to be designated as proficient and qualified for his job.

In order to select passages from which to develop the readability formula, copies of the regulations and manuals identified by DA Pamphlet 12- Series were obtained for the seven MOSs listed. The assembled job reading materials were sampled by scanning the pages for appropriate passages. Passages were deemed appropriate if they contained 150 words of prose (excluding tables) on either one subject or two closely related subjects. Passages were also selected to represent the MOSs as evenly as possible.

Using the modified Flesch formula (2), each sample passage was assigned a screening readability index value. Twelve of these passages were then selected to provide a full range of readability, from the easiest to the most difficult, encountered in the sampled job reading material. These passages are presented in Appendix A.

SELECTION OF STRUCTURAL PROPERTIES OF TEXT

A literature search on the subject of readability yielded a list of some 40 structural properties of passages that had been used in one readability formula or another. By eliminating those variables that were essentially duplicates or were not feasible for our purposes because they required special competence or equipment, the candidate list of structural properties of passages was reduced to 15. These variables and the manner in which they were obtained are described below.

(1) Sentences: The number of sentences was counted, up to and including the 150th word of each standard 150-word passage. The sentence containing the 150th word

was counted only if that word occurred in the latter half of that sentence. Each heading was counted as a sentence.

(2) Words per sentence: The number of words in the sample (150) was divided by the number of sentences.

(3) Independent clauses: The number of independent clauses in 150 words was counted. An independent clause containing the 150th word was counted only if that word occurred in the latter half of that clause.

(4) Words per independent clause: The number of words (150) was divided by the number of independent clauses.

(5) One-syllable words: The number of one-syllable words in 150 words was counted. Syllabification was determined by the spoken language; for example, the number 14 was treated as the two-syllable word "four-teen." Hyphenated words were treated as a single word, and were considered polysyllabic. In case of doubt, a dictionary was consulted.

(6) Difficult words: This was the number of words out of 150 that did not appear on the Dale list of 3,000 familiar words (5). Each difficult word was counted each time it appeared.

(7) Different difficult words: The number of first occurrences of the difficult words in 150 words was counted.

(8) Different words: The number of first occurrences only of words in 150 words was recorded.

(9) Three-or-more-syllable words: This was the number of words of three or more syllables in 150 words.

(10) Total number of syllables: The number of syllables in 150 words was alculated.

(11) Total letters: This was the number of letters and digits in 150 words.

(12) Syllables per sentence: The number of syllables in 150 words was divided by the number of sentences.

(13) Letters per sentence: The number of letters in 150 words was divided by the number of sentences.

(14) Seven-or-more-letter words: The number of words in 150 having more than six letters or digits was counted.

(15) Different three-or-more-syllable words: The number of different words having three or more syllables in 150 words was tallied.

Each of the 12 experimental passages (Appendix A) was assessed to determine its value for each of the 15 structural properties listed. These figures are shown in Appendix B.

THE CLOZE PROCEDURE AS A MEASURE OF COMPREHENSION

In the development of the FORCAST readability formula, an individual's comprehension of the experimental passages was assessed by means of the cloze test procedure (7). In constructing a cloze test, every fifth (or *n*th) word of a passage is deleted and replaced by a blank line of standard length. In administering the test, subjects are instructed to fill in the blanks in the passages, and their comprehension of these passages is indexed by the percentage of omitted words that they correctly provide.

The cloze procedure was used in the READNEED research as an alternative to the index of comprehension that is obtained by constructing multiple choice questions about each passage. The latter procedure has two major drawbacks that led to the decision against using it. First, the construction of multiple-choice questions is highly subjective, and hence both the definition of the important content to be comprehended and the nature, form, and difficulty of the questions may be expected to vary greatly depending

upon the individual preparing the questions. Second, the maximum number of comprehension questions possible for a 50-word passage would be far smaller than the 30 items provided by the five-cycle cloze test of the same material.

Research has indicated that, although there is no single definitive method for measuring reading comprehension, the "mechanical" cloze procedure has consistently yielded very high correlations with multiple-choice tests and other more subjectively constructed measures of comprehension and difficulty (7, 8, 9, 10, 11). Therefore, the weight of the evidence indicates that the cloze test provides a *valid* measure of reading comprehension. The fact that it is also strictly objective, and that *n* independent alternate forms can be created simply by deleting every *n*th word counting from the first, second, . . . or *n*th word from the beginning of the passage, further encouraged the use of the cloze procedure in the READNEED research.

RELATIONSHIPS OF READING GRADE LEVEL TO COMPREHENSION OF ARMY TECHNICAL MATERIALS

Before one can relate different structural properties of a passage to the reading difficulty level of the passage, it is necessary to establish the latter through testing procedures. Working with school children, previous researchers (3, 6) have specified the reading difficulty levels of a passage by asserting a criterion, such as 75% correct on a multiple-choice comprehension test on the passage, and determining the lowest school grade at which the *average* comprehension score meets the criterion. This school grade—for instance, eighth grade—is then taken as the reading grade level for which the passage is comprehensible, and the passage is said to be of eighth-grade reading difficulty.

As a modification of this procedure, students may be tested on a standardized reading test, and also on their ability to comprehend test passages. A determination then may be made of the lowest measured reading grade level at which the *average* comprehension score for the test passages matches the criterion—in our example, 75% correct. Using this procedure, it is possible to say that persons scoring at the seventh-grade level on the standardized test score, on the average, 75% correct on the comprehension test. The test passage then is said to be of seventh-grade reading difficulty.

In the case of the adult Army population, there are doubts about the meaningfulness of the literal interpretation of a grade-level expression of reading ability determined by grade-school reading tests. Nevertheless, the expression of the reading grade level norm is useful as a roughly common metric for comparing reading ability of an individual and the reading ability required to understand a passage—even without reference to school grades. For this reason, the second procedure outlined was used in developing the FORCAST formula.

On the basis of prior research (8, 9), the criterion of comprehension for the READNEED experimental passages was established as 35% correct on the cloze test for a passage. The referenced research has indicated that, with a cloze score of 35% correct, one might reasonably expect to obtain about 70% correct on a multiple-choice test built for the passage.

To determine reading grade levels of men achieving the 35% correct criterion for each of the 12 experimental passages, use was made of the Reading test, U.S. Armed Forces Institute (USAFI) Achievement Tests III, Abbreviated Edition, Form A (a special printing of the Metropolitan Achievement Test, Advanced Battery). This test was administered to 395 unselected Army recruits undergoing Reception Station processing at Fort Ord, California, in February and March of 1971.

In the testing sessions, the men were first given the USAFI reading test. Immediately afterwards, each man was given one variation of a set of six experimental cloze passages, and tested on his comprehension of the passages.

The 12 experimental passages were divided into two sets of six passages because of limitations in testing time and a man's endurance in taking tests. About half (200) the men were administered the six test passages numbered with the initial digit 1, and the other half (195) the test passages numbered with the initial digit 2 (Appendix A). The two sets of cloze passages were judmentally equated on difficulty. Each set was prepared in each of five variations: In the first variation, every fifth word was deleted, starting with the *first* word; in the second variation, every fifth word was deleted, starting with the *second* word, and so forth, until five variations were prepared. By this means, cloze scores were obtained for *all* words in a passage. Each of the cloze passages was scored as the number of correct responses; the maximum for each passage was 30. Except for minor spelling errors, a response was scored as correct only if it exactly matched the deleted word.

The USAFI reading comprehension passages were scored in standard fashion, with raw scores converted to reading grade level scores having a possible range of grades from 1.3 to 12.9. Because different men took different passage sets, and *a priori* efforts to equate the two sets of passages for reading difficulty were not entirely successful, it is important to note that the two groups of men were of equal reading ability. USAFI reading grade level means for the two subsamples of men were 9.40 and 9.42, with standard deviations of 2.7 and 2.5, respectively. On this basis, data from the two separate sets of passages were pooled into one set of 12 passages.

With routine testing instructions, testing was completed in a two-hour period.

RESULTS

AFQT AND READING GRADE LEVEL DISTRIBUTIONS FOR THE SUBJECT SAMPLE

Table 1 presents the percentage distributions of AFQT and reading level in the sample of men tested on the USAFI Reading and cloze test passages. Both show wide

Table 1

Percentage Distribution of Subjects by AFQT Level and USAFI Reading Grade Level
(N = 395)

AFQT Level	Percent	Reading Grade	Percent
10-19	8.9	2	0.8
20-29	10.9	3	2.0
30-39	17.0	4	4.3
40-49	11.7	5	6.6
50-59	12.2	6	6.6
60-69	8.1	7	7.1
70-79	11.2	8	14.2
80-89	12.2	9	10.3
90-99	7.6	10	7.8
—	—	11	25.0
—	—	12	15.1
Total	100	Total	100

distribution ranges. The wide range of abilities of the sample and limited testing time necessitated the compromise choice of an intermediate-level reading scale with a ceiling RGL of 12.9 that was too low to differentiate the more able readers in the sample. Thus, more than 40% of the sample obtained reading scores at the 11th and 12th grade levels. Although they are fully descriptive of *this sample*, these distributions are not necessarily representative of general Army input, because of the limited testing time and single location (Fort Ord) of the sampling.

INTERCORRELATIONS AMONG READING MEASURES AND AFQT

This study made use of reading measures from two sources, the USAFI Achievement Test and cloze tests of the experimental passages. The USAFI test is composed of two parts—Reading (paragraph comprehension tested by four alternative multiple-choice tests) and Word Knowledge (vocabulary test by the same type of multiple-choice procedure); by combining the two parts, the USAFI Composite score is obtained.

In the cloze tests, as mentioned previously, a given subject was administered only six of the 12 experimental cloze test passages; therefore, there are *two sets* of cloze tests, series 11-16 and 21-26. Table 2 presents the intercorrelations among these measures and also AFQT. The relationship between USAFI Reading and the cloze total for each of the two sets of six passages, .83 and .75, is sufficiently high to indicate appreciable correspondence between these two reading-comprehension measures. USAFI Word-Knowledge and Reading scores are highly related to each other and show almost identical relationships to the other variables. The composite score affords little gain over either of its components. The consistent relationship (*r*s ranging from .68 to .72) between AFQT and the four reading measures reflects the large reading component of the AFQT (one-quarter vocabulary and one-quarter arithmetic *word problems*).

Table 2

Intercorrelations Among Reading Measures and AFQT

Reading Measure	1	2	3	4	5	6
1 USAFI Reading		.85	.96	.83	.75	.68
2 USAFI Word Knowledge			.96	.85	.75	.68
3 USAFI Composite				.87	.78	.71
4 Cloze (11-16)						.72
5 Cloze (21-26)						.68
6 AFQT						

The most significant aspect of the data in Table 2 is that *the high correlations among the cloze tests and USAFI Reading test support the previous statement that the cloze test procedure produces at least as valid a measure of comprehension as the typical multiple-choice test procedure.*

CLOZE TEST RESULTS

The means and standard deviations (SD) of the cloze percent-correct scores for the experimental passages, in order of increasing difficulty, are shown in rows 5 and 6 of Table 3. These scores are expressed as the percentage of correct answers given to the 30 cloze items on each of the 150-word experimental passages. Given the adult level and the technical nature of the reading passages, the range of these means (19.4-54.0%) corresponds well with the typical findings generated by this measure when it is applied to passages that differ markedly in difficulty (10). With the simplest elementary school reading material, average cloze scores of even the most proficient adult readers do not exceed 65-70% correct (8, 9, 10). The variability (SD) among subjects tested is notably uniform from passage to passage.

Table 3

Readability Levels by Different Measures and Cloze Percent-Correct Scores for Individual Passages

Property	Passages											
	21	12	11	13	23	22	15	16	26	25	24	14
1. Scaled RGL	6.0	7.0	7.0	7.3	9.1	9.6	11.4	11.8	12.0	12.0	12.1	13.0
2. FORCAST Readability Level	8.6	7.8	7.6	9.4	10.1	10.7	12.1	13.2	12.2	13.2	11.3	10.9
3. Flesch Readability Level	7	6	5	7	13-16	10-12	13-16	16+	16+	16+	13-16	13-16
4. Dale-Chall Readability Level	7-8	7-8	5-6	7-8	11-12	9-10	13-15	16+	16+	16+	13-15	13-15
5. Cloze Mean Score	54.0	46.7	45.1	45.7	35.1	33.5	27.3	25.4	25.0	23.1	23.9	19.4
6. Cloze SD (%)	15.9	17.9	17.7	17.4	14.4	14.3	14.4	15.0	16.0	14.3	13.8	14.4

Table 3 also presents the scaled reading-grade-level (RGL) score that was assigned to these passages by use of the cloze criterion of 35% correct (Row 1). In readability research using multiple-choice items to measure passage comprehension, it has been common practice to regard a score of 75% correct as indicating comprehension of the passage (6, 8, 9). This percentage, depending as it does upon the generally unknown difficulty of the multiple-choice questions, was initially arbitrary, but has tended to become conventional. Comparative studies (8, 9) indicate that a cloze score of 40% correct corresponds, approximately, to this criterion of 75% correct on multiple-choice tests of comprehension. In the present research we have adopted the somewhat lower criterion of 35% correct on the cloze measure as our criterion of passage comprehension. This corresponds to about 70% correct on a multiple-choice test of comprehension, a criterion level frequently used in Army testing. Using this criterion, the readability or comprehensibility of a passage, expressed in terms of reading grade level (RGL), was determined as *the lowest reading grade level in which 50% of the men reading at that grade level achieved a cloze score at or above the 35% correct criterion level.* It is this scaled RGL score that is shown for each experimental passage in Row 1 of Table 3.

To interpret Table 3, note in Row 5 that passage 21 has a cloze score of 54% correct, and, from Row 1, a scaled RGL score of 6.0. This means that 50% of the men

who read at the 6.0 level, as measured by the USAFI Achievement test, achieved at least 35% correct on the cloze test for passage 21. A similar interpretation holds for the remaining passages.

Data on which the determination of scaled RGL for each passage in Row 1 of Table 3 is based are contained in Appendix C. To permit examination of the consequences of adopting a different criterion level of comprehension, parallel data are given there for the 30, 35, 40, and 45% correct levels of comprehension.

Although the procedure for constructing a cloze test (replacing every fifth word with a blank) is certainly objective, the difficulty of a test so constructed may vary as a function of which starting place is selected—and thus, which fifth of the words are deleted. Because of this, in the present research, each set of six experimental cloze tests was administered in five variations. In the first variation every fifth word, starting with the first word, was deleted, in the second variation every fifth word, starting with the second word was deleted, and so forth. Thus, every word in every passage served as a cloze test item for one-fifth of the subjects. Mean percent correct cloze scores for *each* of the five variations are shown in Appendix D.

For many passages, the variability of the mean cloze score from variation to variation is substantial. Since only about 40 men were tested on any one variation of a set of six passages, it is likely that differences in reading ability among men randomly receiving different variations, as well as differences in cloze test difficulty due to the variations, contribute to the differences in cloze scores among the variations shown in Appendix D.

In the following description of the development of the FORCAST readability formula, cloze scores were computed by summing over all versions of the cloze tests for each passage.

CONSTRUCTION OF THE FORCAST READABILITY INDEX

To this point, the steps taken to construct a job-related readability index have been described:

(1) Determination of jobs to be included.
(2) Determination of essential job reading materials.
(3) Selection and assessment of reading passages from the job reading materials in terms of their appropriate structural properties.
(4) Measurement of individual reader's comprehension of passages using the job reading materials.
(5) Scaling of passages by the reading grade level (RGL) required for a designated criterion level of comprehension.

A final step involved determining optimal weights of the structural properties of passages to enter into a formula to maximize the prediction of the RGL required to comprehend a passage at the designated criterion level. Table 4 presents the intercorrelations among the 15 variables characterizing the structure of the experimental passages and their relationship to the mean cloze scores on these passages (summed over all reading grade levels and over all variations of the cloze tests for each passage). While the interrelations among the various structural properties are of some interest, because they suggest the extent to which a structural property covaries with another like property and may be substituted for it in a readability formula, major interest is in the relationship of each of the structural properties to the cloze score (Column 16 of Table 4).

Of the several structural variables showing high correlation with the cloze score, the number of one-syllable words is preferred for the FORCAST readability index. Not only has it been found useful in other, general-purpose readability indices, it is also the easiest

Table 4

Intercorrelations of Passage Structural Property Variables and Mean Cloze Score

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Number of sentences		−.91	.98	−.94	.54	−.53	−.59	.07	−.42	−.51	−.43	−.90	−.90	−.50	−.52	.59
2 Words per sentence			−.85	.99	−.47	.39	.38	−.12	.31	.40	.33	.95	.96	.42	.38	−.52
3 Number of independent clauses				−.90	.57	−.57	−.63	.12	−.46	−.55	−.47	−.85	−.85	−.53	−.55	.58
4 Words per independent clause					−.52	.45	.45	−.14	.37	.46	.39	.96	.97	.47	.44	−.56
5 Number of one-syllable words						−.95	−.90	.11	−.94	−.98	−.98	−.70	−.68	−.98	−.96	.86
6 Number of difficult words							.96	−.23	.95	.97	.95	.62	.59	.92	.92	−.87
7 Number of different difficult words								−.03	.88	.91	.89	.59	.57	.87	.90	−.86
8 Number of different words									−.22	−.18	−.13		−.13	−.11	−.02	.11
9 Number of three-or-more syllable words										.98	.98			.94	.96	−.77
10 Total number of syllables											.99	.6		.97	.98	−.82
11 Total number of letters												.59	.57	.98	.97	−.81
12 Syllables per sentence													.99	.66	.63	−.68
13 Letters per sentence														.64	.60	−.67
14 Number of words of seven or more letters															.95	−.78
15 Number of different three-or-more syllable words																−.80
16 Mean cloze score																

measure to apply. Moreover, the relationship is sufficiently high (.86) to permit its use in a simple, single-variable readability formula.

In order to determine whether combinations of these 15 structural variables might relate more closely to mean cloze score than did any single variable, selected sets of two and three variables were examined by the multiple-linear-regression technique. As shown in Appendix E, this approach provided no practical advantage and was discontinued. In view of the high redundancy among the predictors, the outcome was not surprising.

The correlation between the one-syllable words and cloze scores permits the estimation of a cloze score for a given passage based upon the number of one-syllable words in the passage. While such an estimate may be of interest for some purposes, it is more generally desired that the reading difficulty of a passage be stated in terms of the RGL of difficulty of the material. Accordingly, the correlations between one-syllable words and the RGL associated with the cloze performance criterion (35% correct) were calculated for each passage as given in Table 3. This correlation was .87.

Regression analysis produced the following preliminary readability formula:

$$RGL = 20.43 - (.11)\ (number\ of\ one\text{-}syllable\ words) \qquad (1)$$

The values 20.43 and .11 were reduced to 20 and .10,[2] and .10 was changed to 1/10, in order to produce the very simple readability formula dubbed FORCAST (FORd, CAylor, STicht). The FORCAST formula is:

$$FORCAST\ readability\ in\ RGL = 20 - \frac{number\ of\ one\text{-}syllable\ words}{10} \qquad (2)$$

To use the FORCAST formula to predict the RGL readability of a 150-word passage, one (a) counts the number of one-syllable words in the 150-word passage, (b) divides that number by 10, and (c) subtracts that value from 20.

For example, the estimateeed RGL of readability of a 150-word passage containing 96 one-syllable words would be 20 - 9.6 = 10.4, or about the middle of the 10th-grade level. This corresponds to the prediction that, on the average, men reading at the grade 10.4 level would be expected to get 35% correct on a five-cycle cloze test for the passage.

APPLYING AND EVALUATING THE FORMULA

LIMITATIONS TO THE FORCAST READABILITY FORMULA

The FORCAST formula was developed for and on a defined body of reading material (Army technical job reading matter) and a defined population of readers (young male soldiers). Unlike most general-purpose readability formulas, it was not intended for use with elementary and secondary school materials, or with newspaper and magazines, and its applicability to these is not demonstrated.

One apparent limitation to the FORCAST index is its restricted range. In the unlikely limiting case that all words in a 150-word passage of job material should be monosyllabic, the readability of the passage would be indexed as fifth grade (5.0) and the index will go no lower. To date, no passages of such low readability have been encountered in Army job material and a diligent search was necessary to turn up a

[2] This simplification is obtained at some slight cost in precision. For more precise determination the

passage as low as the 6.0 scaled reading grade level passage used in the experimental list. At the other extreme, the fact that a maximum score on the USAFI scale used in this study was normed as RGL 12.9 set this as the upper limit that could be assigned to the readability of a passage in developing the FORCAST formula. FORCAST predictions above that point are based upon linear extrapolation. However, any reading measure appropriate to the wide range of soldiers' reading ability must similarly be based upon extrapolation at both extremes. Any passage characterized as the 12th grade readability is a difficult one, and there is little need in practical application for precision beyond the simple ordering of even more difficult passages.

RELATIONSHIP AMONG FORCAST, FLESCH, AND DALE-CHALL READABILITY MEASURES

Table 5 presents intercorrelations among FORCAST, Flesch, and Dale-Chall readability indices and scaled reading grade level (RGL) scores for the experimental passages. From the high intercorrelations among the three readability indices, it is apparent that they are functioning in a highly parallel fashion in ordering the experimental passages on readability. Similarly, they are all highly, and about equally, related to the scaled RGL required to comprehend the passages.

Table 5

Development of the FORCAST Formula: Means and Intercorrelations of Four Indexes of Passage Difficulty

Index	Intercorrelation				Mean	SD
	1	2	3	4		
1 FORCAST	—	.92	.94	.87	10.6	1.9
2 Flesch	.92	—	.97	.92	11.8	4.4
3 Dale-Chall	.94	.97	—	.93	11.6	3.9
4 Scaled RGL	.87	.92	.93	—	9.9	2.5

While the Flesch and Dale-Chall formulas, developed on general educational material and readers, show high validity in the present situation, because of the simplicity of the FORCAST formula, it is a more desirable readability formula for use whenever adult technical materials must be evaluated by relatively unsophisticated clerical personnel.

CROSS-VALIDATION

A cross-validation study was conducted in order to determine the validity of the FORCAST readability index for a sample of Army job reading material independent of that on which it was empirically derived. The initial design was replicated, using another sample of 12 Army job reading passages from the same MOSs and another sample of 365 Army recruits at the Fort Ord Reception Station. Passages ranged from RGL 7.0 to 12.7 as indexed by the FORCAST formula.

As indicated in Table 6, the FORCAST values for the 12 passages correlated .77

grade level at which 50% of the men at that level made a score of at least 35% correct on the cloze test of the passage. Mean FORCAST and scaled RGL scores for the 12 passages were 9.4 and 10.4, respectively.

Table 6

Cross-Validation of the FORCAST Formula: Means and Intercorrelations Among Four Indexes of Passage Difficulty

Index	Intercorrelation				Mean	SD
	1	2	3	4		
1 FORCAST	—	.98	.95	.77	9.4	2.0
2 Flesch	.98	—	.94	.78	9.4	4.2
3 Dale-Chall	.95	.94	—	.86	9.5	4.0
4 Scaled RGL	.77	.78	.86	—	10.4	2.2

The generally high *r*s between the FORCAST and the Flesch and Dale-Chall formulas were again found. With this new set of passages, the latter formulas were more accurate in estimating the mean of the scaled RGL. In general, the results of this cross-validation are, within normal sampling fluctuation limits, fully consonant with the basic findings and warrant the use of the FORCAST index for its intended purpose.

USING THE FORCAST READABILITY FORMULA WITH ARMY TECHNICAL MATERIAL

The FORCAST index was developed to provide an estimate of the reading ability level required to read and understand Army job reading material. It can be applied to a single passage, a sample of material from an MOS, or the entire body of reading material in an MOS. To obtain an estimate of the reading grade level of difficulty of materials in the seven MOSs from which the READNEED experimental passages were obtained, the formula was applied to all the materials sampled in each MOS. These materials represent the reading materials that a man must study to pass his MOS proficiency test (unless he can learn the information in some other way); these are, then, critical job reading materials. The manuals and regulations containing the prescribed job reading material, as well as the number of samples taken of each publication, are listed in Appendix F.

Table 7 presents, for each MOS, the cumulative percentage of job reading materials for each of seven grade levels of difficulty, estimated by the FORCAST formula. Using the reading grade level 9 to 9.9 as the best estimate of the average reading ability range of the general Army population (see Table 1 and reference 12), these seven MOSs can be ranked on how well the reading difficulty of materials in the MOS matches the average reading ability of Army personnel (i.e., 9 to 9.9). Applying this procedure, we find that the Medical Specialist (91B20) has the largest proportion (24.4%) of materials written at or below the 9.9 reading level, and is the least demanding of reading skills. The remaining MOSs have the following percentage of material written at the 9.9 level: Light Weapons Infantryman, 18.3%; Military Policeman, 15.1%; General Vehicle Repairman, 13.4%; Armorer/Unit Supply Specialist, 10.8%; Ground Control Radar Repairman, 4.2%; Personnel Specialist, 2.2%.

Table 7

Cumulative Percentage Distribution of Job Reading Materials for Seven MOSs and Seven FORCAST Readability Levels

RGL[a]	Military Occupational Specialty[b]						
	11B20 (N = 104)	26D20 (N = 95)	63B20 (N = 108)	71H20 (N = 95)	76Y20 (N = 83)	91B20 (N = 90)	95B20 (N = 138)
6-6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-7.9	1.0	0.0	0.0	0.0	0.0	0.0	0.7
8-8.9	4.8	2.0	3.3	1.1	3.6	2.2	5.0
9-9.9	18.3	4.2	13.4	2.2	10.8	24.4	15.1
10-10.9	41.4	9.5	36.3	3.3	20.4	47.8	34.0
11-11.9	71.2	42.1	61.8	37.0	57.6	77.8	62.2
12.0+	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]RGL—Reading Grade Level of difficulty of job printed materials determined by the FORCAST formula.

[b]11B20, Light Weapons Infantryman; 26D20, Ground Control Radar Repairman; 63B20, Wheel Vehicle Repairman; 71H20, Personnel Specialist; 76Y20, Armorer/Unit Supply Specialist; 91B20, Medical Specialist; 95B20, Military Policeman.

Although there are clear differences in readability of job printed materials among the MOSs, *all* the MOSs show readability levels well above the ninth-grade level. These findings confirm previous observations (1, 4), and once again suggest that quality-control procedures should be applied to printed materials in order to make them more useful to the majority of personnel.

Chapter 3

3 READING REQUIREMENTS ESTIMATED FROM THE PRIMARY MOS ENLISTED EVALUATION TEST

ELEMENTS IN ESTIMATING READING REQUIREMENTS

A procedure using data from current Army data banks for estimating functional literacy requirements of Army MOSs is discussed in this chapter. Functional literacy is defined here as that level of reading ability that is *minimally sufficient* for *satisfactory* job performance. In principle, the task is straightforward: To determine the literacy requirements of a job, one needs a sample of job incumbents, a measure of their reading ability, and a measure of their job proficiency—along with an authoritative definition of the level of job performance that is "satisfactory." In view of the typical, positive relationship between literacy and job knowledge (1), the job reading requirement can be readily determined, through correlational analyses, as the minimum literacy level associated with "satisfactory" job performance.

Given the minimum necessary data—reading scores, job-proficiency scores, and a decision on what constitutes a satisfactory level of job proficiency—it is possible to apply this procedure to any MOS.

READING SCORES

Except for some Project 100,000 men, there are no direct measures of reading ability in Army personnel records. However, there is consistent evidence of the substantial relationship between AFQT and reading grade level. For approximately 1,500 job incumbents of widely varying job experience in four MOSs, the AFQT-standardized reading test correlation was .68 (1), and for three 200-man groups of unselected recruits in a Reception Station, median *r* was .79 (1). For men entering Combat Support Training (CST) in three MOSs, the median *r* was .75, as it was for three samples of about 200 men each upon completion of CST (Chapter 4). An *r* of .68 was found in another Reception Station sample of 395 recruits; in this case, a different standardized reading test was used (Chapter 2).

The stability and level of this relationship, in conjunction with the consistent linearity of the regression, indicate that reading scores, although not directly available, can be meaningfully estimated from AFQT. Admittedly, the AFQT-based estimates of reading ability are imprecise, but the loss of precision is unavoidable in any case of regression-based estimates. If such a procedure as described herein were to be undertaken operationally, it probably would be because of the ready availability of the AFQT in personnel records, and the desire to avoid the expense of wide-scale testing of reading-skill levels—a trade-off of precision for cost savings and convenience.

JOB-PROFICIENCY MEASURES

The annual, mandatory, Primary MOS Enlisted Evaluation Test (MOS/ET) score

proficiency in his MOS. The MOS/ET (based upon multiple-choice, job-knowledge items submitted by the proponent agency for the MOS) is centrally revised, administered, and scored by the Army Enlisted Evaluation Center. The score on the 125-item test is available as an independent entity. Its identity, however, is lost when it is merged in weighted combination with the Enlisted Efficiency Report (EER) rating and the resulting composite score is normed and recorded in the individual's files for use in MOS verification, Specialty and Superior Performance Pay qualification, and other personnel actions. The MOS/ET score is taken as the most authoritative and objective index of job proficiency available in existing Army administrative records.

CRITERION LEVEL OF JOB PERFORMANCE

The empirical answer to the question, "How well must a man read to do the job?" depends upon two factors: (a) the empirical relationship between reading and job proficiency in that MOS, and (b) the judgmental decision as to how much proficiency it takes to "do the job."

At present, criterion scores defining adequate proficiency on the MOS/ETs are set by the proponent agencies for each MOS, in conference with the Enlisted Evaluation Center. Such criterion scores are based jointly on a consideration of the distribution of proficiency scores in the MOS/ET, the best judgment of the proponent agency as to its manpower needs, and experience-based expectations about the likelihood of successful job performance by men scoring below the criterion score.

Whatever the bases for setting criterion scores, it is sufficient for the READNEED research that such criteria *are* in existence, and thus we have the elements in existing, standard records for estimating reading level requirements of any Army MOS—AFQTs, from which reading ability may be estimated, and an objective, administratively sanctioned measure of job proficiency to serve as a criterion to which reading ability may be related.[1]

PROCEDURE

The general procedure for estimating the reading demands of a given MOS consists of six steps:

(1) Select the MOSs to be studied.
(2) Select a sample of men carrying that MOS.
(3) Extract AFQT, and MOS/ET scores from existing records for each member of the sample.
(4) Compute the mean MOS/ET scores for men at each AFQT decile.

[1] Although these data are available, they are not to be found in a common source. Scores on the MOS/ET are available in the records of the Enlisted Evaluation Center (EEC); AFQT scores for all EM are stored on PERSINCOM's Enlisted Master Tape Records (EMTR) and subsidiary tapes as well as in the 201 Files for these men at the Enlisted Personnel Support Center (AFPERCEN). Although the PERSINCOM tapes contain the PMOS Enlisted Evaluation Score and the AFQT, the MOS/ET and Enlisted Efficiency Rating (EER) composite, which is the Enlisted Evaluation Score, is not considered an appropriate criterion measure for this research because data (1) indicate that the rating component is not likely to be substantially related to job knowledge. Conceptually, the procedure described remains unaltered by the lack of a common source for AFQT and MOS/ET scores; in practice one step is added. Since data are in ADP format at both PERSINCOM and EEC, the sample for men in a given MOS can be selected from either source and, through matching Social Security numbers, the second datum can be obtained from the other source. Such is the procedure that has been followed in the present work.

(5) Ascertain the lowest AFQT level at which the proponent-based MOS/ET criterion level is met.
(6) Convert that AFQT level to a reading grade level equivalent using the standard regression equation provided in this report.

These steps will be described as they were accomplished in the present research.

SELECTING MOSs

Three criteria were used in selecting the MOSs whose reading level requirements were studied. They were representative of a wide range of job families and job requirements, they were linked with other READNEED and REALISTIC research on MOS reading requirements, and data were available on a timely basis.

The following MOSs were chosen for study:

11B20 Light Weapons Infantryman
31E20 Field Radio Repairman
63B20 Wheel Vehicle Mechanic
71H20 Personnel Specialist
76Y20 Armor/Unit Supply Specialist
91B20 Medical Specialist
95B20 Military Policeman

SELECTING PERSONNEL SAMPLE AND OBTAINING SCORES

For each of the seven MOSs, a sizable sample of MOS/ET data was obtained, and for each MOS, the Enlisted Evaluation Center (EEC) provided the following data for a sample of 400 men:

- Name
- Social Security Account Number (SSAN)
- Pay Grade
- Enlisted Evaluation Test Score (MOS/ET)
- Enlisted Efficiency Report rating score (EER)
- Minimum Passing EET Score established by the proponent agency for the MOS

From these samples, a subset of 100 men was selected for each MOS in order to provide a full range of MOS/ET scores *with a heavy concentration of subjects in the region of the minimum passing score on the MOS/ET established by the proponent agency for that MOS.* AFQT scores for these men were extracted from their 201 files at the U.S. Personnel Services Support Center (AGPERCEN).[2] Between the varying dates of MOS/ET testing in the different MOSs and the time the READNEED research assistant entered the AGPERCEN files, a considerable interval had elapsed. To varying degrees in the different MOSs, 201 files of men who were selected for study were no longer available because, in the interim these men had completed their term of active duty. Subjects whose 201 files were not available were replaced from the 400-man rosters by substitutes with MOS/ET scores as nearly equivalent as possible. In the Wheel Vehicle Mechanic MOS, in particular, there were insufficient low-scoring MOS/ET substitutes available from the 400-man sample to provide the intended distribution of MOS/ET scores. This somewhat tortuous tryout procedure resulted in a set of approximately 100 subjects in each of the MOSs who were distributed on AFQT, EER (Enlisted Efficiency

[2]Time limits precluded the less cumbersome procedure of extracting AFQT scores from the PERSINCOM tapes. This would be the recommended procedure in an operational program.

Rating), and MOS/ET as shown in Table 8. The minimum passing MOS/ET score set by the proponent agencies for these MOSs is also shown in this table.

Table 8

Percentage Distributions of AFQT, EER, MOS/ET, and MPRTS Scores

Test	MOS						
	11B Infantry (N = 107)	31E Electronics (N = 98)	63B Mechanic (N = 100)	71H Personnel (N = 101)	76Y Supply (N = 98)	91B Medical (N = 99)	95B MP (N = 100)
AFQT							
91-99	5	20	1	9	4	5	1
81-90	3	20	4	15	4	9	17
71-80	7	11	6	16	2	8	21
61-70	6	8	7	12	9	6	11
51-60	5	8	11	8	8	15	14
41-50	15	11	13	14	11	15	9
31-40	21	7	28	12	25	28	14
21-30	19	9	11	5	16	9	6
11-20	20	6	19	9	21	5	7
EER							
91-125	78	90	69	85	73	84	80
81-90	9	8	10	7	7	7	8
71-80	5	1	6	2	8	6	9
61-70	2	1	7	1	6	1	–
51-60	1	–	4	2	4	1	2
41-50	–	–	3	2	–	–	–
0-40	5	–	1	1	2	1	1
MOS/ET							
91-125	–	8	2	–	2	5	–
81-90	–	19	7	3	11	14	11
71-80	14	13	22	16	18	18	28
61-70	17	15	31	20	23	26	25
51-60	17	17	14	33	18	20	12
41-50	18	10	15	17	16	12	18
0-40	34	17	9	11	12	5	6
Minimum passing score (MPRTS) set by proponent agency	43	60	42	57	59	65	46

Differences between MOSs in the proportions of men at a given MOS/ET score level reflect only a decision to *oversample* in the region of the minimum passing test score. Beyond showing a wide range of MOS/ET scores with greatly fluctuating sampling density in each MOS, these MOS/ET distributions have no further independent meaning. Similarly, the AFQT distributions do not represent random samples of that variable in these MOSs and are presented only to show the range and relative frequency of AFQT scores in these present data.

Correlational analysis indicated that the relationship between AFQT and EER ratings was trivial, median r for the seven MOSs being .05. This, in conjunction with the previous findings of inconsequential relationships between EER and AFQT, reading, job knowledge, or job sample performance (1) led to dropping the EER ratings from further analysis. While the place of the EER in indexing an essential component of total job proficiency in the work setting is recognized, it shows no useful relationship to literacy or to the measurable components of job proficiency mediated by reading.

RELATING MOS/ET TO AFQT AND READING ABILITY

The procedure for estimating the reading requirements of MOSs consists of determining the lowest AFQT level at which job incumbents do, on the average, attain a specified criterion level on the MOS/ET, and of estimating the reading grade for that level of AFQT.

To ascertain how MOS/ET performance varied with AFQT, mean MOS/ET scores were computed for men at each decile of AFQT (Table 9). These data were then smoothed by computing weighted MOS/ET means for adjacent AFQT deciles, and a least squares best linear fit was applied to the resulting values in each MOS. These data are shown separately by MOS in Figure 1. For simultaneous comparison, the linear regression lines for all MOSs are brought together in Figure 2. It is apparent, for these seven MOSs, that, to varying but substantial degrees, MOS/ET performance does increase as a positive function of AFQT.

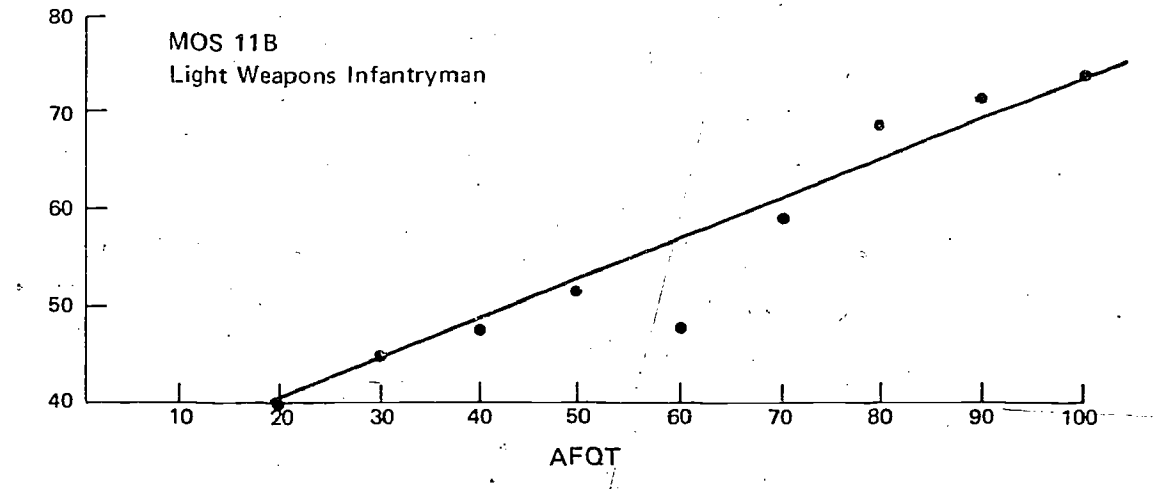
Table 9

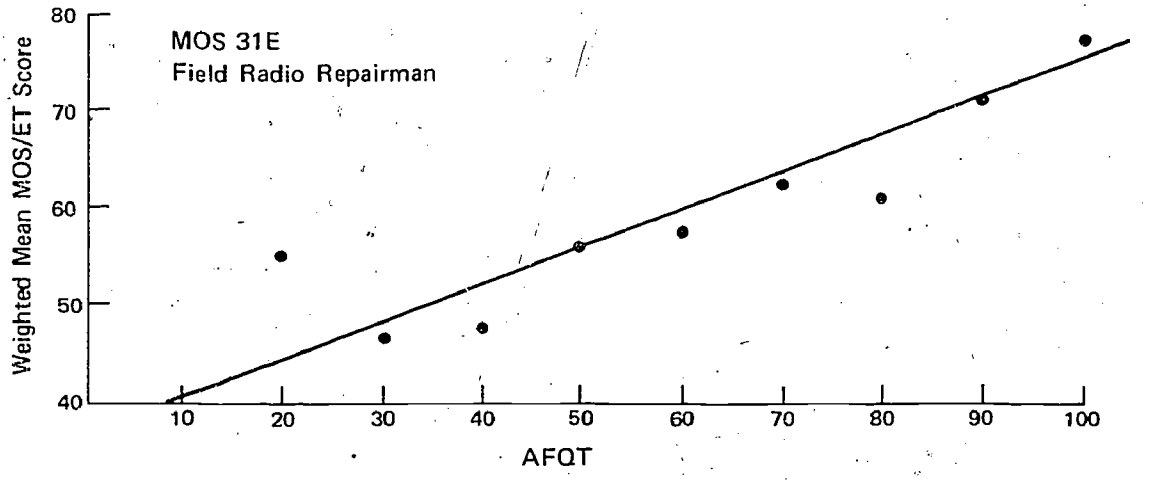
Mean MOS/ET Scores by AFQT Decile

AFQT	MOS						
	11B Infantry	31E Electronics	63B Mechanic	71H Personnel	76Y Supply	91B Medical	95B MP
11-20	39.9	55.3	56.8	56.7	46.4	67.4	49.0
21-30	44.8	46.8	60.6	32.4	52.0	68.3	66.3
31-40	47.5	47.7	57.5	50.2	62.2	60.1	58.5
41-50	51.6	56.2	67.5	55.6	63.4	59.9	51.9
51-60	47.8	57.5	62.4	63.5	71.4	65.8	64.9
61-70	59.2	62.8	76.9	57.3	72.8	68.7	68.7
71-80	68.7	61.1	71.0	57.2	80.5	73.2	76.1
81-90	71.7	71.2	75.8	67.4	83.8	71.4	66.4
91-99	74.0	77.6	69.0	69.0	83.2	78.2	83.0

Shown immediately below the AFQT level designations in Figure 2 are the reading levels associated with those levels of AFQT. Reading grade levels were estimated from the AFQT on the basis of a sample of 393 unselected recruits at the Fort Ord Reception Station in which the correlation between AFQT and RGL scores on the USAFI Achievement Tests III (Abbreviated Edition) Form A was .68 (see Chapter 2). The RGLs estimated from the AFQT by the regression equation [estimated USAFI = .075 (AFQT) + 5.52] are shown in Figure 3.

Relationship Between AFQT and MOS/ET Scores for Seven MOSs





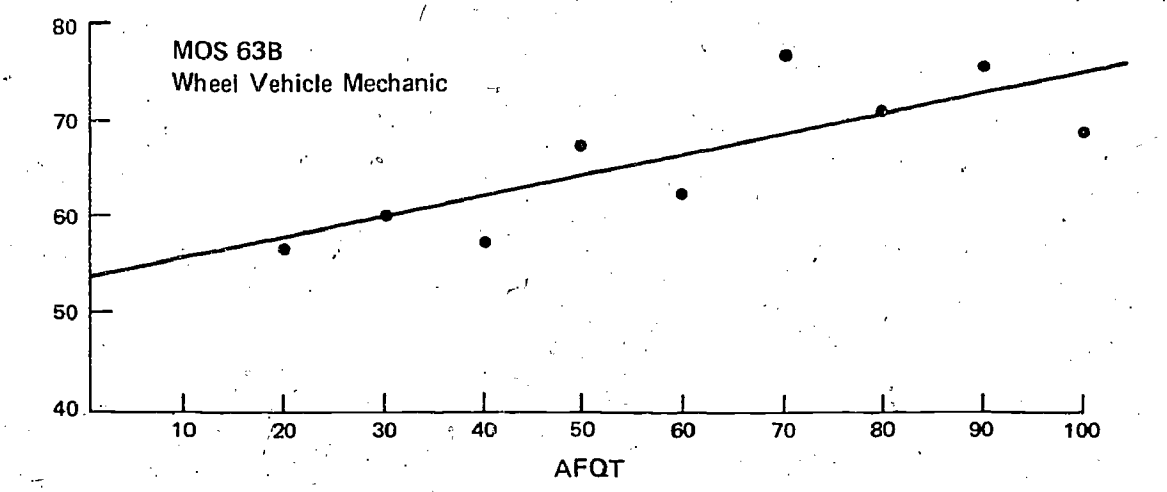
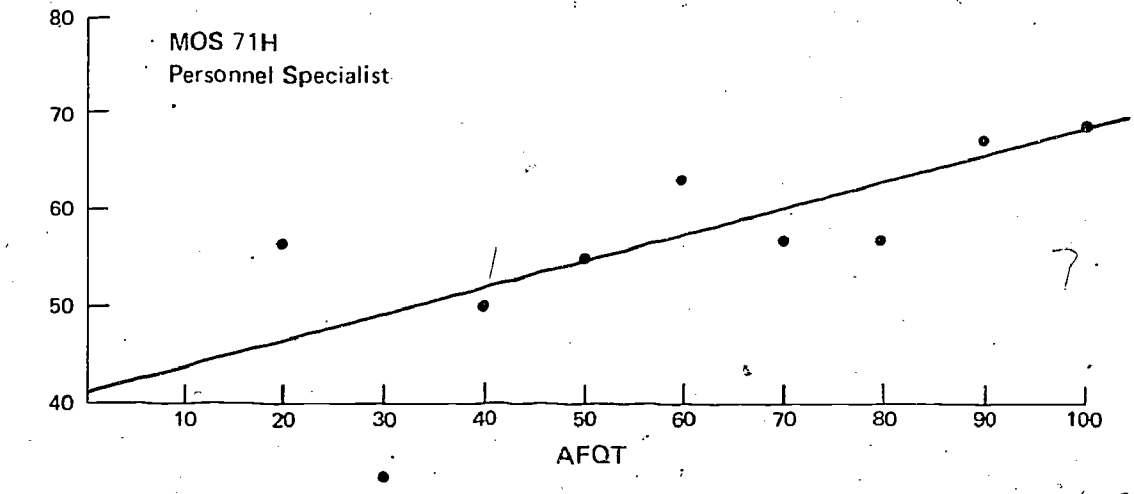
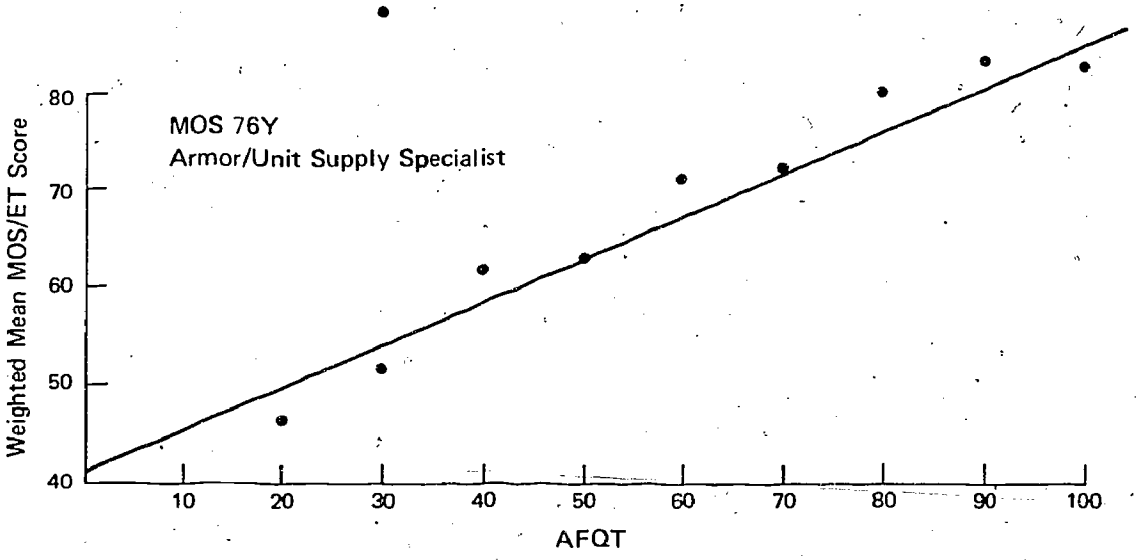


Figure 1 (Continued)

Relationship Between AFQT and MOS/ET Scores for Seven MOSs *(Continued)*





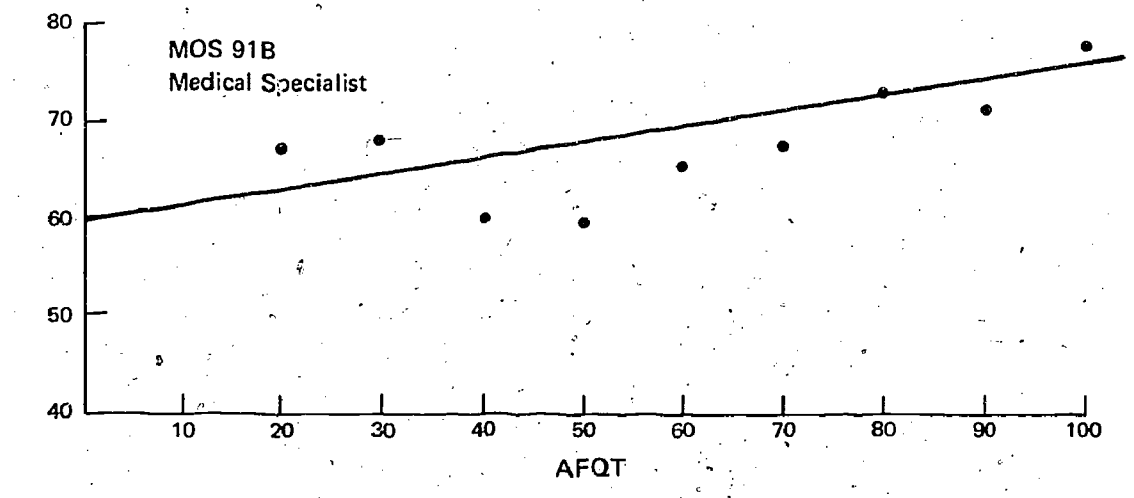


Figure 1 (Continued)

Relationship Between AFQT and MOS/ET Scores for Seven MOSs *(Continued)*

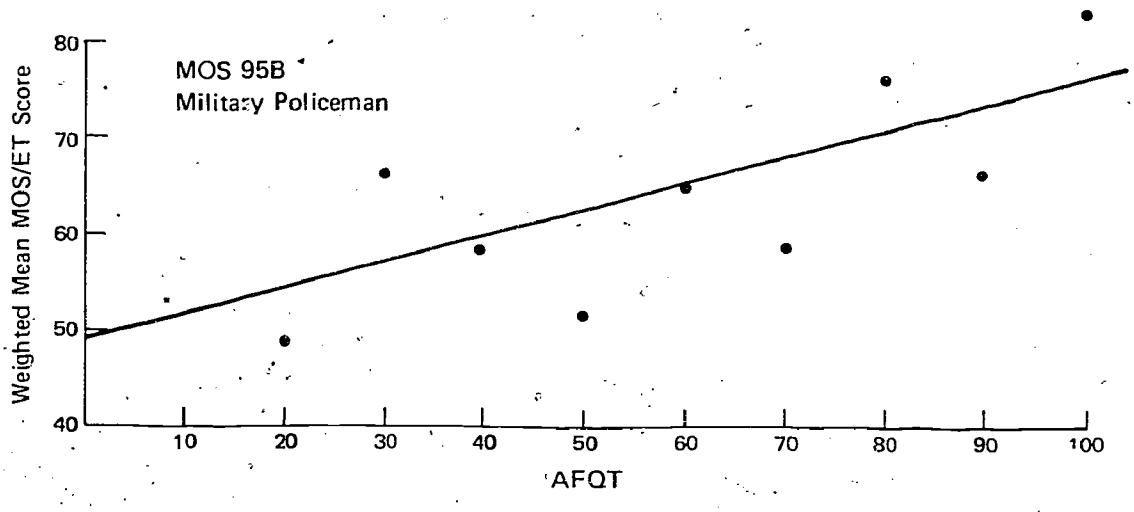


Figure 1

Relationship Between AFQT, RGL Equivalent, and MOS/ET Scores

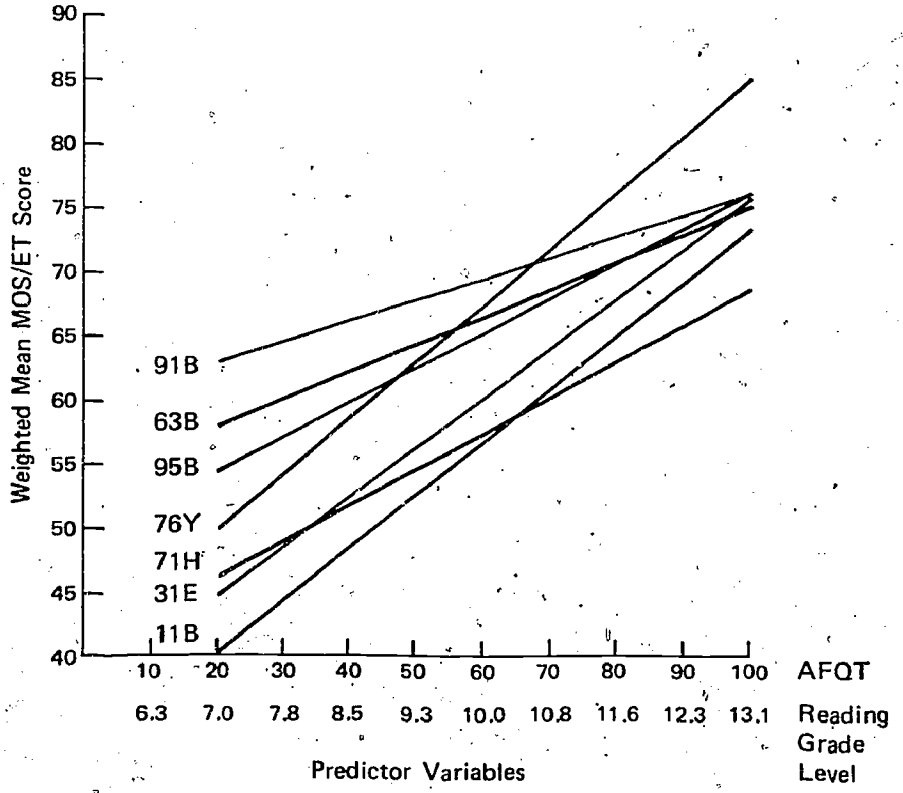


Figure 2

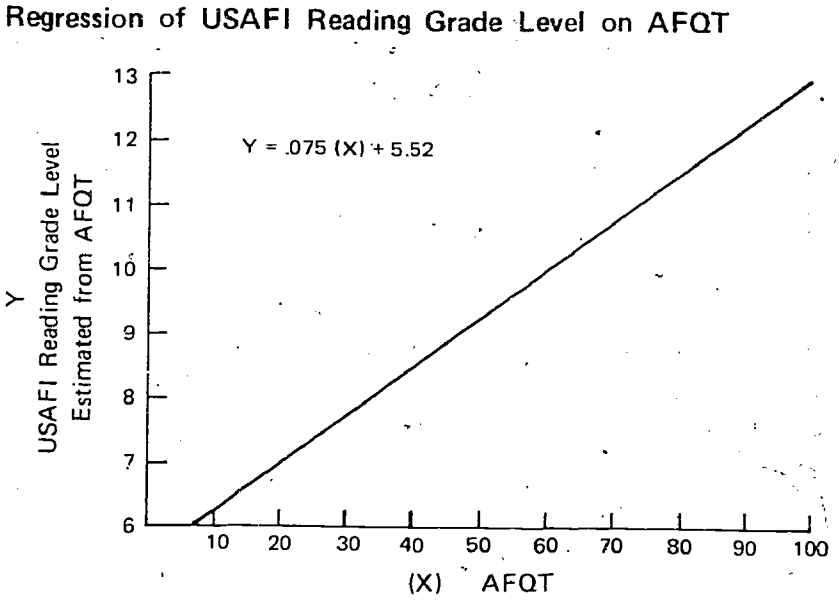


Figure 3

From Figure 2, the estimated reading level requirements for the seven MOSs can be read off directly—provided that one has a criterion level of an MOS/ET score defining satisfactory performance.

As mentioned earlier, in present practice the proponent agency for each MOS defines such a criterion by setting a minimum passing MOS/ET score as *one* requirement for an incumbent's maintaining his MOS classification. For MOS 11B20, Light Weapons Infantryman, the MOS/ET criterion level for 1971 was set at 43. In looking at Figure 2, it can be seen that by entering the MOS/ET ordinate at 43, then moving right until encountering the MOS 11B20 line, and then moving vertically down to the abscissa, an average MOS/ET score of 43 is obtained at an AFQT score of 26. By interpolation of the bottom line of Figure 2 (or from Figure 3) one can see that for AFQT 26, the corresponding reading grade level is 7.5. Thus, the reading requirement for MOS 11B is determined as being at the seventh- to eighth-grade level of reading ability.

Each MOS has its own Enlisted Evaluation Test and its own minimum passing score established by its proponent agency. Table 10 shows the minimum passing test scores for the seven MOSs and their reading-grade-level requirements determined as above. For MOSs 63B and 95B (Wheel Vehicle Mechanic and Military Policeman), minimum passing MOS/ET scores are set so low that it precludes determining the reading requirement of the MOSs any more precisely than below the seventh-grade reading level. For the other MOSs, the reading requirement ranges from 7.5 to 9.9. Men reading below the reading level requirement for their MOS do not, on the average, meet this minimum-criterion level of job proficiency on the mandatory MOS/ET.

THE EFFECTS OF INCREASING THE CRITERION LEVEL

The minimum passing scores are set for reasons of personnel administration, and reflect retention policies determined, in part, by supply and demand considerations. In view of the fact that on these 125-item, four-alternative, multiple-choice tests random guessing would yield an average score of 31.25, the minimum passing criterion in some MOSs is truly minimal. Table 10 illustrates the effects of increasing the MOS/ET criterion

Table 10

MOS Reading Requirements Under Various Criteria

MOS	MPTS[a]	RGL[b]	MOS/ET Items Correct		
			60	65	70
Infantry, 11B	43	7.5	10.3	11.1	12.0
Electronics, 31E	60	9.8	9.8	10.8	11.7
Mechanic, 63B	42	[c]	7.6	9.4	11.1
Personnel, 71H	57	9.8	10.6	11.9	13.0
Supply, 76Y	59	8.1	8.3	9.2	10.0
Medical, 91B	65	8.6	6.6	8.6	10.7
MP, 95B	46	[c]	8.5	9.9	11.3

[a]Minimum passing MOS/ET score defined by proponent agency.
[b]Reading Grade Level.
[c]Below 7.0 reading grade level.

on the estimated reading requirements. Data are presented for criterion scores of 60, 65, and 70 items correct on the MOS/ET.

Considering that these criterion levels respectively represent 48, 52, and 56% of the maximum possible score on the MOS/ET, the reading-level requirements rise sharply in these MOSs for these nominally small increments in proficiency definition. Not only are these tests measuring with great sensitivity in this middle range of possible scores, *there is also the indication that a substantial portion of MOS/ET job-knowledge items are rarely passed.*

At the 60-items-correct criterion level, literacy requirements differ considerably over MOSs, ranging from reading grade levels 6.8 to 10.5. Differences between MOSs in literacy requirements directly express differences in AFQT, and indirectly express differences in estimated reading grade level at which incumbents attain 48% of maximum on these tests of MOS job knowledge. At higher criterion levels, job reading requirements increase and differences between MOSs shrink as the effective ceiling is approached.

The level of reading required for an MOS reflects the criterion level established as sufficient by management. Generally speaking, the higher this criterion of proficiency, the more demanding the requirement for literacy. There is, then, no *single* unitary level of reading skill to be designated as *the* job reading level requirement. Rather, there are as many levels of reading requirements as there are levels of job proficiency; the determination of the job-proficiency level deemed sufficient is *not* the proper province of the researcher, but is rather a decision to be made by the responsible management.

For the above reasons, the entire procedure described in this chapter rests squarely on the MOS/ET as Army management's choice of measures of job-relevant and job-essential knowledge. This position is buttressed by the Army's use of the MOS/ET score as a *sufficient* measure in itself for invalidating an MOS classification and, in conjunction with the EER, as the *sufficient* measure for selective awarding of proficiency pay.

The purpose of establishing the job reading requirement for an MOS is to determine how well men must read in order to do their job with a desired level of proficiency, particularly when the desired level of proficiency increases beyond that of the break-in apprenticeship period. Given the present and probable literacy levels of Army input in the future, it does not seem likely that MOSs can be fully manned by men already possessing the literacy skill levels required by these MOSs for satisfactory job performance. Rather, the establishment of MOS reading level requirements below which job proficiency is inadequate serves to specify existing objectives, which, to the extent that they cannot be met by selection and classification, constitute training goals against which the effectiveness of literacy and job-training programs can be gauged. In this regard, it should be noted that for those five MOSs for which data of Figure 2 permit a determinate solution, the MOS reading requirement ranges from 2.5 to 4.9 reading grade levels above the fifth-grade graduation criterion of the current Army remedial reading program! These data (and others, 1) indicate that such training should minimally aim at producing seventh-grade reading ability.[3]

[3] Work to produce a prototype Army literacy-training program targeted at producing grade 7.0 reading skill level is under way in HumRRO Work Unit FLIT.

Chapter 4

DEVELOPMENT, STANDARDIZATION, AND VALIDATION OF JOB READING TASK TESTS FOR THREE MOSs

The methods for establishing literacy requirements of Army MOSs which were described in Chapters 2 and 3, are relatively simple and inexpensive, but they do not involve the direct assessment of the ability to read and understand job reading materials. The readability approach of Chapter 2 estimates the ease of learning from or of utilizing job reading materials on the basis of a count of simple structural properties of the text. The use of existing Army data bank information to estimate reading demands of jobs (Chapter 3) is based upon an actual job reading task—the Primary MOS Enlisted Evaluation Test (MOS/ET)—but it also reflects a combination of reading ability and job knowledge. In addition, this test is a low-frequency job reading task, and is not representative of the day-to-day reading tasks performed by men in the course of doing their jobs.

In this chapter, a third approach for determining reading demands of jobs will be described. In this approach, the reading ability requirement of a job has been conceptualized as the ability to perform the day-to-day reading tasks of that job—that is, to obtain that information required to do the job from the standard printed job reading materials. The correlational analysis method was used to assess relationships between the reading ability of men in the Army, as established by standardized, grade-school referenced tests, and their performance on Job Reading Task Tests for three Army MOSs: Vehicle Repairman, MOS 63C; Unit and Organization Supply Clerk, MOS 76Y; and Cook, MOS 94B. Additionally, this research has developed standardization and normative data on Job Reading Task Tests (JRTT) based on Army recruit input.

A second objective of this research was to determine the effects on JRTT performance of specific aptitude for a job (defined as having been assigned to training for that job, which presumably reflects prior interest, information, ability, and experience in that job area), and also the combined effects on JRTT performance of having been assigned to a job area, and having completed MOS training in that job area.

Finally, this research has produced data showing relationships among AFQT, Standardized Reading Test (SRT) performance, JRTT, and end-of-course MOS academic scores.

DEVELOPMENT OF JOB READING TASK TESTS

CONCEPTUALIZING JOB READING TASKS

Job tasks can be roughly categorized into those for which reading is an inherent, directly involved part of the task, such as reading incoming correspondence to determine appropriate action, and those for which reading is not an inherent aspect of the task, such as changing a tire on a truck. In the latter instance, however, written manuals may exist telling exactly how the tire is to be changed, and the formal, prescribed job task may be to change the tire *in accordance with the directions in the manual*. While reading skill is not needed to perform the ultimate task (changing the tire), there is an enabling

task—reading the manual—involved in making certain that the tire is changed according to the specified procedure.

Most Army jobs appear to contain tasks of this nature; for most tasks and jobs there is an appropriate manual or regulation that provides step-by-step directions for performing the tasks. Although many of these tasks can be learned by "show-and-tell," and hence do not require that the person be able to read, reading the manual is a part, not always explicitly recognized, of the formal job task. Thus, in the Army, to say that a particular task requires no reading skill may indicate failure to recognize the formal job requirement. On the other hand, to always recognize the formal task requirement would be tantamount to asserting that practically *all* Army tasks require reading skill and hence are job reading tasks.

The foregoing comments highlight one of the conceptual problems encountered in attempting to identify job reading tasks. If the officially prescribed job tasks form the basis for identifying reading tasks, then reading task tests may be constructed for tasks that, in fact, are not performed on the job. Thus, if supervisors or management people are asked to determine what materials a man must be able to read and use, they are likely to respond in terms of the formal job prescription, or what they believe, ideally, a man should be able to read and comprehend.

In the present research, an approach has been used to determine job reading tasks that provide a sample of reading tasks reported by job incumbents interviewed at their job sites. This approach ignores formal job prescriptions, and concentrates instead on the day-to-day reading tasks that men perform—whether in accordance with doctrine or not. It also focuses directly on reading tasks, rather than on job tasks for which reading might be simply an enabling skill. This procedure greatly compresses the time, cost, and effort that would otherwise be involved in job/task analysis.

IDENTIFYING JOB READING TASKS

The identification of job reading tasks and the construction of JRTT were performed under Work Unit REALISTIC. Methodology, test development, procedures, and subjects have been described in detail in the technical report (1) and will be only summarized here.

To determine job reading tasks, men in the three MOSs (63C, 76Y, and 94B) were administered structured interviews at their job locations. In the interview, each man was asked to give five examples of the times during the "past month or so" when he had been doing some job task and had had to (a) consult some printed job material, (b) tell what information he had been seeking, and (c) describe the job task he had been performing. Then he was asked to get the manual or other printed job material, to locate the exact page or part he had used, and to show the interviewer the specific material needed to obtain the desired information. This process was repeated until either five instances had been described or the individual could give no more examples. In any event, he was not pressed to give more than five examples.

The men interviewed were first-enlistment men with total time on the job ranging from 1 to 18 months and the data refer to job reading tasks for entry and apprentice level job performance.

There were 30 men interviewed in the Supply MOS, 48 in the Cook's MOS, and 85 in the Repairman's MOS. The men represented three levels of literacy skill[1]—grade levels 4 to 6.9, 7 to 8.9, and 9+—with approximately equal distribution over the three levels.

[1] Determined by prior administration of the Survey of Reading Achievement, Junior High Level, California Test Bureau.

CONSTRUCTING JOB READING TASK TESTS

As mentioned previously, each of the men interviewed was asked to cite five instances in which he had used printed materials in his work in the last month or so. Copies of the printed materials cited by the men in the three MOSs were subsequently obtained. A scheme was devised by which each page or section of reading materials cited could be classified by the "content type" of information it displayed. The classification system used for categorizing the various materials is presented in Table 11.

Table 11

Job Printed Material Content-Type Categories

Category	Definition
1. Tables of Content and Indexes	Content designating the location of information within a publication.
2. Standards and Specifications	Content setting forth specific rules or tolerances to which task procedures or the completed product must conform.
3. Identification and Physical Description	Content attempting to symbolically represent an object via an identifying code (stock number, nomenclature) and/or by itemizing its distinguishing physical attributes.
4. Procedural Directions	Content presenting a step-by-step description of how to carry out a specific job activity. Essential elements are equipment/materials/ingredients to be used, and how they are to be used, with presentation organized in a sequential step-wise fashion.
5. Procedural Check Points	Content presenting a key word or highly summarized version of what should be done in carrying out a task rather than how it should be done. This content differs from the content classified under Procedural Directions in that it assumes the user knows how to carry out the steps once reminded that the step exists and/or reminded of the decision factors that determine whether the step is required.
6. Functional Description	Content presenting an operating (cause and effect, dependency relationships) description of some existing physical system or subsystem, or an existing administrative system or subsystem.

In using this classification scheme to construct reading task tests, the printed materials cited by the men in each MOS were sorted into the six different content categories. Setting aside Category 1 (tables of contents and indexes that were obvious and simple to classify), the materials in the remaining five categories were sorted independently by two judges, who agreed on 87, 80, and 96% of their initial judgments in the Repairman, Supply, and Cook jobs, respectively. However, in the process of sorting materials, difficulties of the classification scheme became apparent. For instance, should the unit of classification be based upon a line (sentence or two) or a paragraph, or a major subsection of a technical manual? How should pictorial materials be classified? To expedite the present research, materials were classified on the basis of the major

subsection of a publication. Thus, a section that gave the procedures for filling out a form was classified Procedural Directions, even though standards and specifications may have been given in the material.

From the data about the kind of information a man had been seeking when he used the material, and with copies of the printed materials cited, job-related reading task tests were constructed. These tests represented the most frequently mentioned reading material content types, and required the man being tested to find the kind of information from the materials that job incumbents reported seeking. No prior knowledge that was specific to the job was required for answering any of the questions. Three separate tests were constructed, each using job-specific MOS materials.

Table 12 lists the subtests in each job reading task test. The variety in the tests for the different jobs reflects the variety of different content types cited by men in the jobs. Where it was possible to complete the readability index, the difficulty level is given in terms of the modified Flesch readability formula (4) for both the job material and the test material. In all measurable cases, the difficulty level of the materials exceeded that of the test questions.

Table 12

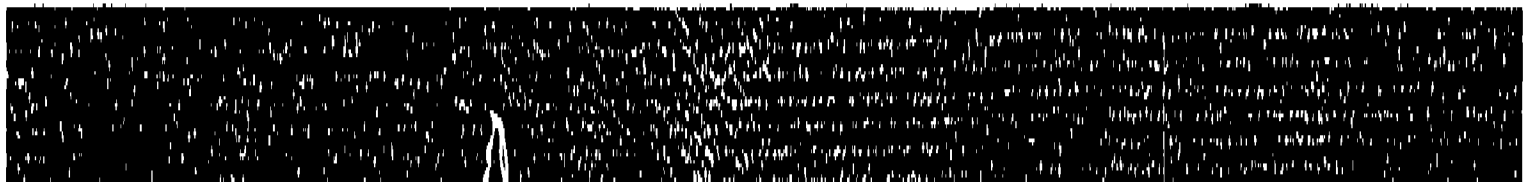
Content Types and Difficulty Levels of Job Reading Task Test Materials and Test Questions

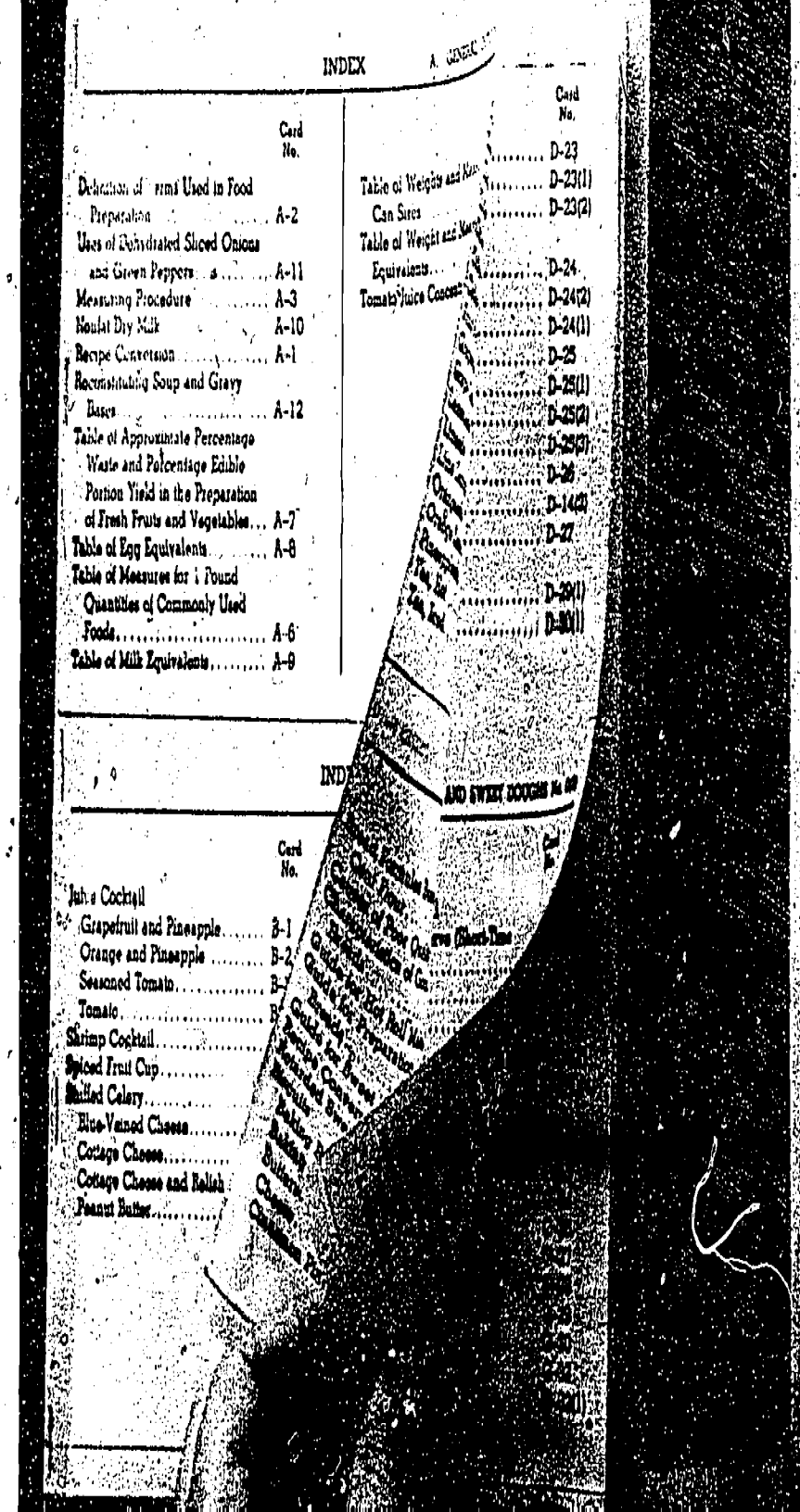
Job	Subtest	Content Type[a]	Reading Difficulty Level[b]	
			Job Material	Test Question
Repairman (MOS 63C)	A	1	N/A	8.5
	B	2	N/A	8.5
	C	4	14.5	8.5
	D	4	N/A	8.5
	E	4	14.5	11.0
	F	6	16+	N/A
	G	5	14.5	8.5
Supply Clerk (MOS 76Y)	A	1	N/A	6.0
	B	2	N/A	8.5
	C	3	N/A	7.0
	D	4	16+	11.0
	E	5	8.5	7.0
Cook (MOS 94B)	A	1	N/A	5.0
	B	4	N/A	7.0
	C	4	7.0	6.0
	D	4	8.5	6.0

[a]Content types follow the numbering in Table 11.
[b]Readability levels in school grade equivalents.

The general nature of the reading task tests is shown in Figure 4, using a portion of the Cook Index test. Questions about the job reading material were presented on the right side of the test booklet and the job-related reading materials were presented on the left side. A similar layout was used for all subtests.

Sample From the Cook's Job Reading Task Test





INDEX

INDEX

5

TEST A NAME: _____

BELOW IS A LIST OF JOBS. NEXT TO EACH JOB IS A BLANK SPACE FOR YOUR ANSWER.

ON THE LEFT SIDE OF THIS BOOKLET IS AN INDEX. YOU ARE TO FIND EACH JOB IN THIS INDEX. WHEN YOU FIND THE JOB IN THE INDEX, YOU WILL SEE A CARD NUMBER TO THE RIGHT OF THE JOB. YOU ARE TO WRITE THIS NUMBER IN THE BLANK SPACE ON THE ANSWER SHEET. NOW, LET'S WORK THROUGH AN EXAMPLE:

EXAMPLE:	JOB	CARD NO.
	TOASTED GARLIC BREAD	_____

LOOK UP THE BREAD SECTION IN THE INDEX. HAS EVERYONE FOUND IT? IT IS ON THE SECOND PAGE OF THE INDEX. UNDER BREADS, YOU SEE SEVERAL DIFFERENT KINDS OF BREAD. FIND THE CARD NUMBER FOR TOASTED GARLIC. NOW, WRITE YOUR ANSWER IN THE BLANK SPACE. YOUR ANSWER SHOULD BE CARD NO. D-7. DID EVERYONE GET THIS ANSWER CORRECT?

DOES EVERYONE UNDERSTAND WHAT HE IS TO DO? IF THERE ARE NO QUESTIONS, PLEASE BEGIN THE TEST. YOU WILL HAVE ___ MINUTES. PLEASE ANSWER ALL THE QUESTIONS.

	JOB	CARD NO.
1.	SPARERIBS AND SAUERKRAUT	_____
2.	BAKED POTATOES	_____
3.	CHILI CON CARNE	_____
4.	WHITE CAKE (SHORTENING, BAKERY, EMULSIFIER)	_____
5.	CHICKEN FRICASSEE	_____
6.	GRIDDLE CAKES	_____
7.	NEW ENGLAND BOILED DINNER	_____
8.	LYONNAISE CARROTS	_____
9.	NEW ENGLAND CLAM CHOWDER	_____
10.	BROWNIES	_____

Figure 4

THE RELATIONSHIP OF READING ABILITY TO JOB READING TASK TEST PERFORMANCE

The relationships of general reading ability to performance on the JRTT were evaluated by administering the JRTT for each MOS and a standardized reading test (SRT) to three groups:

(1) An unselected sample of several hundred Army recruits at the Fort Ord Reception Station, referred to as the RS group.

(2) An unselected sample of several hundred men in their first week of Combat Support Training (CST) for Vehicle Repairman, Supply Clerk, and Cook, referred to as the Pre-CST group.

(3) An unselected group of several hundred men in their next-to-last week of MOS training, referred to as the Post-CST group.

In addition to the administration of the JRTT and SRT, AFQT and end-of-course grades were obtained from administrative files where possible. With the latter grades, it was possible to compute validity coefficients for the JRTT, SRT, and AFQT.

MEANS, STANDARD DEVIATIONS, AND NUMBERS TESTED

For each MOS, Table 13 presents data for AFQT, Standardized Reading Test (SRT) performance in reading grade level (RGL) scores, and scores for each subtest and a total score on the Job Reading Task Tests (JRTT).

A brief comment should be made to explain differences in Ns for the three groups tested. The differences in the RS groups are small, and represent losses caused by the inability to obtain the information from records, and failures to attempt the test. The larger differences between RGL and JRTT for Pre- and Post-CST groups who took the Cook's JRTT resulted from the fact that, after some of the men had been tested on both the SRT and JRTT, a sufficient distribution of RGL scores was obtained to permit a study of the relationship between the two test performances. However, to obtain job information, the Cook's Job Knowledge test[2] and the JRTT were administered to additional men. Thus, more men were tested on the JRTT than on either the SRT or Job Knowledge test, resulting in the differences in Ns for the Cooks. A similar explanation holds for the Post-CST Repairman's group: in this case, the Job Knowledge test for Repairmen[3] was not administered to Pre-CST men. The remaining differences in Ns for any group for AFQT, RGL, or JRTT also are caused by such things as the failure to obtain data from records.

The major data of Table 13 deal with the differences between mean JRTT performance for the RS, Pre-CST, and Post-CST groups. Presumably, the JRTT scores should increase in that order since the RS group is an unselected group, the Pre-CST group was selected for their MOS training because of special aptitude for that work, and the Post-CST group was selected for special MOS aptitude *and* had completed MOS CST training. As the data indicate, although there is some tendency for the scores to increase in the expected manner, there are many reversals, and those changes in the expected direction are trivial and may be the result of differential skill levels in general reading/verbal aptitude, as is suggested by an examination of the RGL and AFQT scores.

A more complete indication of the influence of selection, and of selection plus training on JRTT performance is given in Figures 5, 6, and 7, which present mean

[2] Developed in HumRRO Work Unit UTILITY, 13.
[3] Developed in Work Unit UTILITY.

Table 13

Scores for AFQT, Standardized Reading Test, and Job Reading Task Tests for Three MOSs

Measure	Maximum Possible Score	Mean			Standard Deviation			Number Tested		
		RS	Pre-CST	Post-CST	RS	Pre-CST	Post-CST	RS	Pre-CST	Post-CST
	1	2	3	4	5	6	7	8	9	10
Cook (94B)										
AFQT	99	47.90	39.79	50.69	25.63	24.85	25.85	193	292	212
SRT/RGL	14.5	9.61	8.68	10.06	2.58	2.86	2.58	191	187	217
JRTT A	10	6.79	5.91	7.65	2.59	3.06	2.44	195	322	298
B	10	8.82	8.83	9.28	1.51	2.25	1.25	195	322	298
C	22	17.31	15.62	18.79	5.17	6.18	4.26	195	322	298
D	10	5.18	4.82	6.32	3.60	3.92	3.80	195	322	298
Total*	52	38.10	34.66	42.04	10.6	12.98	9.62	195	322	298
Supply (76Y)										
AFQT	99	49.91	47.82	40.66	26.31	25.60	25.53	220	285	273
SRT/RGL	14.5	9.72	9.68	9.18	2.72	2.52	2.46	222	310	314
JRTT A	10	6.26	7.28	7.19	2.48	2.31	2.12	222	312	315
B	5	3.40	3.93	3.81	1.22	1.03	1.07	222	312	315
C	8	5.87	6.61	6.52	2.12	1.21	1.10	222	312	215
D	16	7.58	9.06	9.16	3.98	3.69	3.12	222	312	315
E	8	5.27	5.79	5.17	2.77	2.69	2.91	222	312	315
Total	47	28.39	32.68	31.84	9.98	8.23	7.39	222	312	315
Repairman (63C)										
AFQT	99	47.62	57.21	54.47	27.32	23.66	26.90	197	214	365
SRT/RGL	14.5	9.42	9.78	9.45	2.72	2.09	2.35	201	219	248
JRTT A	10	6.57	7.20	7.54	1.97	1.63	1.64	201	219	410
B	10	8.72	9.32	9.43	2.15	1.24	1.19	201	219	410
C	3	2.60	2.79	2.79	.71	.51	.51	201	219	410
D	13	9.62	11.04	11.21	2.95	2.40	2.30	201	219	410
E	8	5.75	6.29	6.48	2.01	1.63	1.46	201	219	410
F	11	8.05	8.92	9.35	2.89	2.11	1.93	201	219	410
G	7	4.92	5.59	5.76	2.20	1.81	1.54	201	219	410
Total	62	46.22	51.15	52.56	11.39	7.69	7.55	201	219	410

Repairman's Job Reading Task Test Scores for Men Tested at Reception Station and Pre- and Post-CST

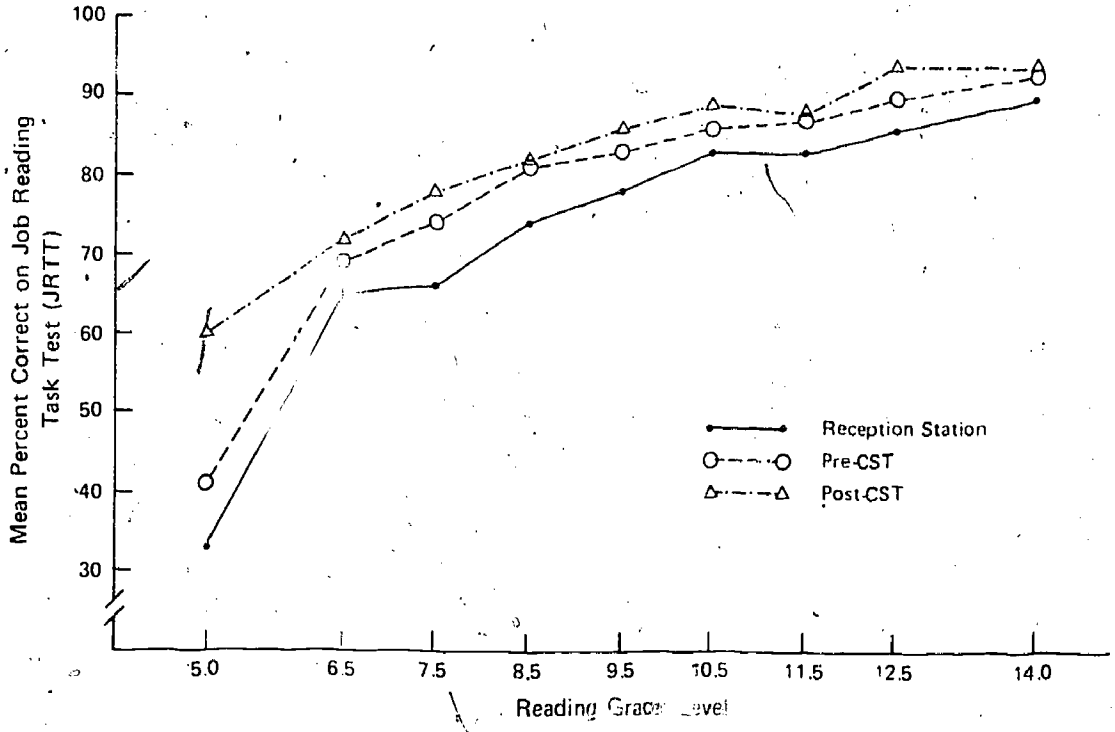


Figure E

Supply Clerk's Job Reading Task Test Scores for Men Tested at Reception Station and Pre- and Post-CST

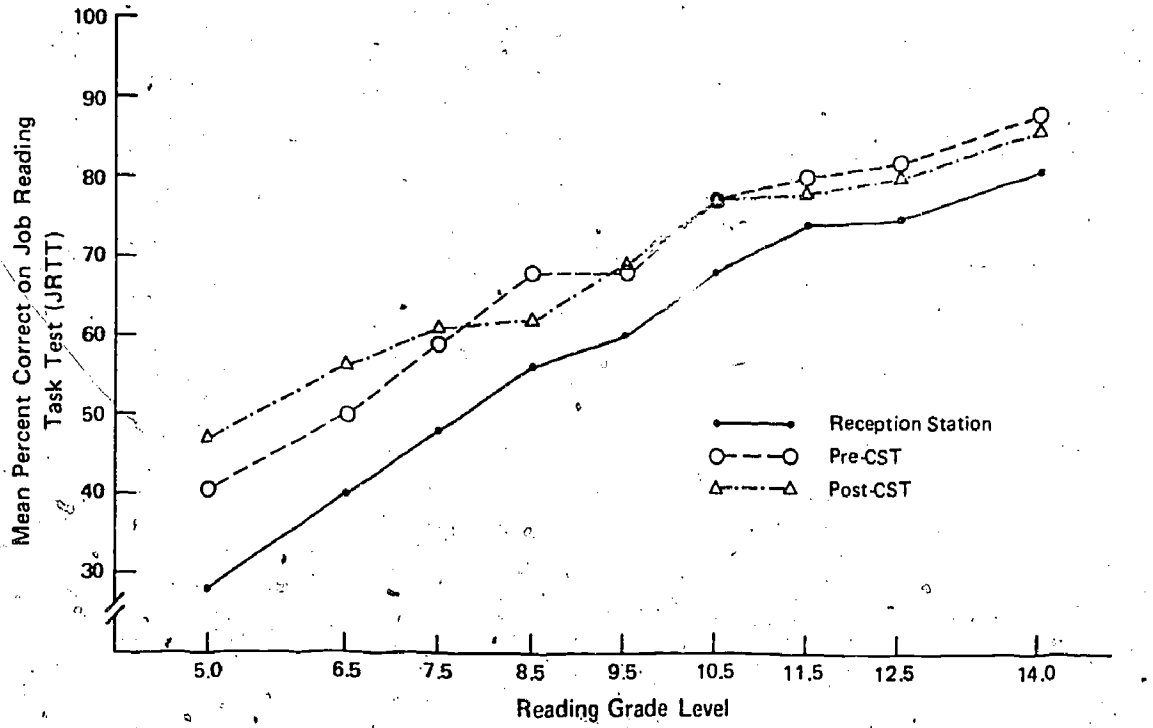


Figure 6

Cook's Job Reading Task Test Scores for Men Tested at Reception Station and Pre- and Post-CST

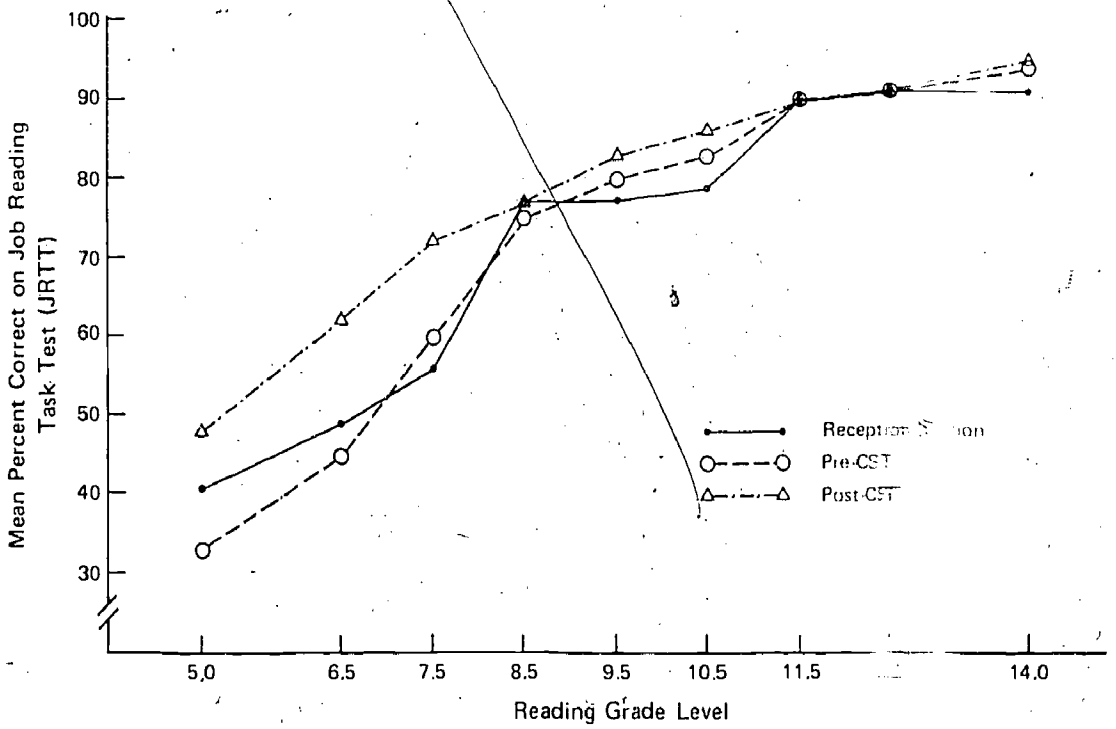


Figure 7

percent correct scores for men of differing reading grade levels in the RS, Pre-CST, and Post-CST groups. The major findings shown is that, while in general the MOS training appears to produce better JRTT performance than that exhibited by the RS or Pre-CST groups, poorer readers exhibit the most gain. The fact that job training improves performance on the JRTT, at least for the poor readers, attests to the validity of the JRTT as measures of job-related reading skills.

A second major finding presented in these figures is that general reading ability is highly related to JRTT performance for all three groups. This is further indicated in the data reported in this chapter.

CORRELATION DATA

Tables 14, 15, and 16 present, for each MOS, intercorrelation matrices for AFQT, SRT (RGL), JRTT and subtests, end-of-course academic (EOCA) grades, and, for Repairmen and Cooks, Job Knowledge test results. These data are presented separately for RS, Pre-CST, and Post-CST groups.

Examining the three tables, it is seen that SRT(RGL) is about equally correlated with AFTQ and JRTT, with *r*s ranging from .66 to .82 for SRT and AFQT, and from .65 to .80 for SRT and JRTT. Thus, to a large extent, these three instruments appear to be measuring similar skills. This is further evidenced by the somewhat lower, yet consistently positive correlation coefficients for AFQT and JRTT. The somewhat lower *r*s for AFQT and JRTT than for AFQT and SRT may reflect the fact that, whereas the AFQT and SRT were constructed to discriminate among testees, the JRTT was designed to measure ability to perform job reading tasks and was not designed to show differences among the men tested.

Table 14

Intercorrelation Table for Vehicle Repairman (MOS 63C)

Variable	Category	1 AFQT		2 SRT(RGL)		3 JRTT Tot.		4 Test A		5 Test B		6 Test C		7 Test D		8 Test E		9 Test F		10 Test G		11 EOCA		12 Job Know.	
		N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r
1 AFQT	Rec. Sta.			199	.79	199	.66	199	.57	199	.44	199	.38	199	.52	199	.42	199	.56	199	.53				
	Pre-CST			214	.73	214	.58	214	.55	214	.38	214	.24	214	.33	214	.22	214	.49	214	.44	201	.58		
	Post-CST			219	.78	365	.65	365	.54	365	.36	365	.30	365	.45	365	.37	365	.58	365	.49	364	.72	146	.72
2 SRT (RGL)	Rec. Sta.					201	.76	201	.62	201	.58	201	.46	201	.45	201	.52	201	.74	201	.62				
	Pre-CST					219	.71	219	.55	219	.49	219	.32	219	.41	219	.32	219	.62	219	.53	205	.60		
	Post-CST					248	.65	248	.54	248	.41	248	.25	248	.42	248	.40	248	.57	248	.51	247	.67		
3 JRTT Tot.	Rec. Sta.							201	.77	201	.80	201	.63	201	.73	201	.75	201	.85	201	.73				
	Pre-CST							219	.71	219	.67	219	.42	219	.71	219	.59	219	.77	219	.67	205	.49		
	Post-CST							410	.75	410	.72	410	.46	410	.72	410	.64	410	.83	410	.68	409	.66	162	.59
4 Test A	Rec. Sta.									201	.58	201	.45	201	.52	201	.45	201	.59	201	.47				
	Pre-CST									219	.50	219	.30	219	.35	219	.30	219	.47	219	.40	205	.47		
	Post-CST									410	.49	410	.28	410	.40	410	.35	410	.60	410	.45	409	.57	162	.48
5 Test B	Rec. Sta.											201	.50	201	.44	201	.56	201	.67	201	.50				
	Pre-CST											219	.24	219	.33	219	.21	219	.45	219	.48	205	.29		
	Post-CST											410	.31	410	.42	410	.38	410	.57	410	.42	409	.45	162	.45
6 Test C	Rec. Sta.													201	.40	201	.46	201	.52	201	.39				
	Pre-CST													219	.28	219	.24	219	.28	219	.15	205	.23		
	Post-CST													410	.28	410	.26	410	.28	410	.36	409	.30	162	.30
7 Test D	Rec. Sta.															201	.46	201	.47	201	.37				
	Pre-CST															219	.34	219	.40	219	.30	205	.32		
	Post-CST															410	.31	410	.51	410	.28	409	.47	162	.40
8 Test E	Rec. Sta.																	201	.56	201	.50				
	Pre-CST																	219	.38	219	.24	205	.19		
	Post-CST																	410	.44	410	.40	409	.34	162	.34
9 Test F	Rec. Sta.																			201	.59				
	Pre-CST																			219	.42	205	.40		
	Post-CST																			410	.47	409	.57	162	.45
10 Test G	Rec. Sta.																								
	Pre-CST																					205	.34		
	Post-CST																					409	.48	162	.36
11 EOCA	Rec. Sta.																								
	Pre-CST																								
	Post-CST																							162	.78

Table 15

Intercorrelation Table for Unit and Organization Supply Clerk (MOS 76Y)

Variable	Category	1 AFQT		2 SRT (RGL)		3 JRTT Tot.		4 Test A		5 Test B		6 Test C		7 Test D		8 Test E		9 EOCA	
		N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r
1	Rec.Sta.			221	.79	221	.65	221	.53	221	.44	221	.49	221	.60	221	.44		
AFQT	Pre-CST			283	.75	285	.60	285	.45	285	.39	285	.32	285	.52	285	.44	245	.60
	Post-CST			273	.75	273	.58	273	.40	273	.42	273	.15	273	.49	273	.43	267	.54
2	Rec.Sta.					222	.78	222	.66	222	.53	222	.62	222	.67	222	.54		
SRT.	Pre-CST					310	.74	310	.56	310	.47	310	.45	310	.62	310	.56	267	.61
(RGL)	Post-CST					314	.70	314	.51	314	.52	314	.20	314	.55	314	.55	314	.55
3	Rec.Sta.							222	.81	222	.66	222	.77	222	.85	222	.78		
JRTT	Pre-CST							312	.76	312	.59	312	.62	312	.83	312	.77	269	.62
Tot.	Post-CST							315	.71	315	.59	315	.48	315	.79	315	.78	308	.62
4	Rec. Sta.									222	.52	222	.58	222	.55	222	.57		
Test A	Pre-CST									312	.43	312	.41	312	.44	312	.51	269	.46
	Post-CST									315	.37	315	.35	315	.37	315	.42	308	.49
5	Rec. Sta.											222	.48	222	.51	222	.38		
Test B	Pre-CST											312	.37	312	.40	312	.34	269	.31
	Post-CST											315	.21	315	.41	315	.35	308	.41
6	Rec. Sta.													222	.52	222	.52		
Test C	Pre-CST													312	.42	312	.37	269	.36
	Post-CST													315	.26	315	.22	308	.24
7	Rec. Sta.															222	.50		
Test D	Pre-CST															312	.45	269	.56
	Post-CST															315	.42	308	.50
8	Rec. Sta.																		
Test E	Pre-CST																	269	.42
	Post-CST																	308	.44

Table 16

Intercorrelation Table for Cooks (MOS 94B)

Variable	Category	1 AFQT		2 SRT (RGL)		3 JRTT Tot.		4 Test A		5 Test B		6 Test C		7 Test D		8 EOCA		9 Job Know.	
		N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r
1	Rec.Sta.			192	.70	194	.64	194	.48	194	.51	194	.60	194	.48				
AFQT	Pre-CST			162	.82	292	.63	292	.55	292	.38	292	.56	292	.56	272	.54	130	.53
	Post-CST			146	.66	212	.54	212	.48	212	.35	212	.51	212	.37	210	.53	66	.72
2	Rec.Sta.					193	.78	193	.68	193	.53	193	.71	193	.56				
SRT	Pre-CST					187	.80	187	.76	187	.59	187	.73	187	.61	172	.59		
(RGL)	Post-CST					217	.73	217	.64	217	.53	217	.67	217	.48	216	.60		
3	Rec.Sta.							195	.83	195	.73	195	.90	195	.75				
JRTT	Pre-CST							322	.86	322	.75	322	.91	322	.77	298	.55	135	.62
Tot.	Post-CST							298	.81	298	.70	298	.89	298	.78	295	.53	81	.74
4	Rec.Sta.									195	.58	195	.68	195	.51				
Test A	Pre-CST									322	.57	322	.70	322	.61	298	.47	135	.51
	Post-CST									298	.57	298	.68	298	.47	295	.45	81	.67
5	Rec.Sta.											195	.64	195	.40				
Test B	Pre-CST											322	.65	322	.44	298	.38	135	.46
	Post-CST											298	.59	298	.41	295	.46	81	.51
6	Rec.Sta.													195	.46				
Test C	Pre-CST													322	.52	298	.48	135	.56
	Post-CST													298	.49	295	.50	81	.69
7	Rec.Sta.																		
Test D	Pre-CST															298	.48	135	.44
	Post-CST															295	.33	81	.59
8	Rec.Sta.																		
EOCA	Pre-CST																	126	.56
	Post-CST																	79	.71

INTERCORRELATIONS AMONG JRTT SUBTESTS AND REMAINING VARIABLES

Generally speaking, the intercorrelations among the subtests for each JRTT are moderate and positive. The lowest *rs* are obtained with the Post-CST data, which probably reflects the most homogeneous nature of the subjects (Table 13, Columns 5, 6, 7) over those of the RS and Pre-CST groups, and the near-ceiling attainment levels (Table 13, Columns 2, 3, 4) of many Post-CST men on subtests with small point values.

For the Reception Station (RS) group, Table 17 presents the relationships of each subtest with the sum of all other subtests in a given MOS JRTT. The *rs* are all moderately high, indicating that each subtest is measuring the same capacities as measured by the sum of the other subtests. These correlations are quite high considering that the JRTTs were not designed to increase the variance among subjects, which would tend to enhance these *rs*. These data, and those of the preceding paragraph, suggest that each subtest provides a moderately effective measure of general reading ability, as well as a measure of job-related reading skills.

Table 17

Correlations of Each Job Reading Task Test Subtest With the Sum of the Other Subtests

Repairman		Supply Clerk		Cook	
Subtest	*r*	Subtest	*r*	Subtest	*r*
A	.68	A	.69	A	.73
B	.71	B	.58	B	.65
C	.59	C	.65	C	.62
D	.57	D	.65	D	.52
E	.65	E	.63		
F	.75				
G	.61				

RELIABILITY OF JRTT

The testing schedule for the Pre-CST and Post-CST groups was such that a small sample of men in each MOS school were included in both groups. For the Repairman, Supply Clerk, and Cook schools, the numbers of men for whom both Pre- and Post-CST scores were available were, respectively, 36, 98, and 37, and test-retest reliabilities for the JRTT were, respectively, .85, .74, and .80. These indicated acceptable levels of stability for the scores on the test instruments.

VALIDITY OF AFQT, SRT, AND JRTT FOR PREDICTING END-OF-COURSE ACADEMIC GRADES

As mentioned before, end-of-course academic (EOCA) grades were obtained for the Pre- and Post-CST groups, and intercorrelations for these grades and AFQT, SRT, and JRTT are presented in Tables 14, 15, and 16. In these tables, it should be noted that the coefficients for the AFQT and Pre-CST groups with the EOCA are predictive validity

coefficients, because the tests were administered seven weeks prior to the awarding of an EOCA grade. On the other hand, the coefficients for the SRT and JRTT with EOCA grades for the Post-CST groups are concurrent validity coefficients, because the reading tests were administered during the last week of CST training, when final EOCA grades were assigned.

Overall, it is clear that the three predictor tests show moderately strong, positive correlations with the EOCA. As expected, the coefficients for the various JRTT subtests are less than for the JRTT total scores, primarily reflecting the reduction in number of items and lower reliabilities of the subtests.

Of note is the fact that the AFQT and SRT, both non-MOS-related measures of reading, are as effective as the JRTT in predicting academic achievement in MOS training, even though the JRTT reflects job-specific reading content and format. Thus, while the JRTTs have greater "face" validity than do the AFQT and SRT, the latter instruments permit the same efficiency of prediction of MOS CST achievement as do the JRTTs.

One remaining piece of evidence concerning the validity of the AFQT and JRTT comes from the Cook's and Repairman's MOSs, in which a number of men were administered the Job Knowledge tests developed by HumRRO Work Unit UTILITY. For the Cook's MOS, the Job Knowledge test and JRTT were administered to men in both the Pre- and Post-CST groups. For the Repairmen, only the Post-CST group took the Job Knowledge tests. Table 16, Column 9, presents intercorrelations for the AFQT, JRTT, and Job Knowledge tests for Pre- and Post-CST in the Cook's MOS. Table 14, Column 12, presents comparable data for the Post-CST Repairman. In all cases, the *rs* are positive and moderately high, suggesting a large component of reading or other verbal ability in performing on the Job Knowledge measures. This is best evidenced by the Cook's Pre-CST data, in which the men had not been taught any job knowledge (Table 16), yet the correlations of AFQT and JRTT with the Job Knowledge test performance are .53 and .62, respectively.

USE OF JRTT TO DETERMINE JOB LITERACY DEMANDS

Figure 8 demonstrates how the JRTT and SRT relationships might be analyzed to determine the reading skills required to perform the job reading tasks. It shows the percentage of men in the Post-CST groups who scored at or above 70% correct on their MOS JRTT, in relation to the SRT reading ability level of the men. The horizontal dotted line crosses each curve at a point where 80% of the men obtain the criterion score of 70% correct on the JRTT. The vertical dotted lines mark the reading grade level on the x-axis at which 80% of the men score 70% or more correct on the JRTT. Thus, if a rule were adopted that stated that the reading level required for satisfactory performance on JRTT is the level at which 80% of the men score 70% or better on the JRTT, then the reading requirement for both the Cook and Repairmen's MOSs would fall in the range of 7 to 7.9, and the Supply MOS would be near 10.

Obviously, the estimates of reading requirements will change as the decision rule is changed. At the limiting case wherein 100% of men are expected to achieve 100% correct on the JRTT, it is clear from Figure 8 that a 10th grade level would be required for Cooks and Repairmen, while the Supply Clerk's reading requirements would be estimated well above the 12th grade level. Decisions concerning how *low* criterion levels might be set must be based upon additional knowledge, such as the supply and demand characteristics of the manpower situation; whether or not literacy training will be provided, and what additional information is available concerning the reading demands of jobs (Chapters 2 and 3 and in the REALISTIC, 1, research). Certain of these considerations are

Percent of Post-CST Men at Each Reading Grade Level Scoring 70% or Higher on the Job Reading Task Tests for Three MOSs

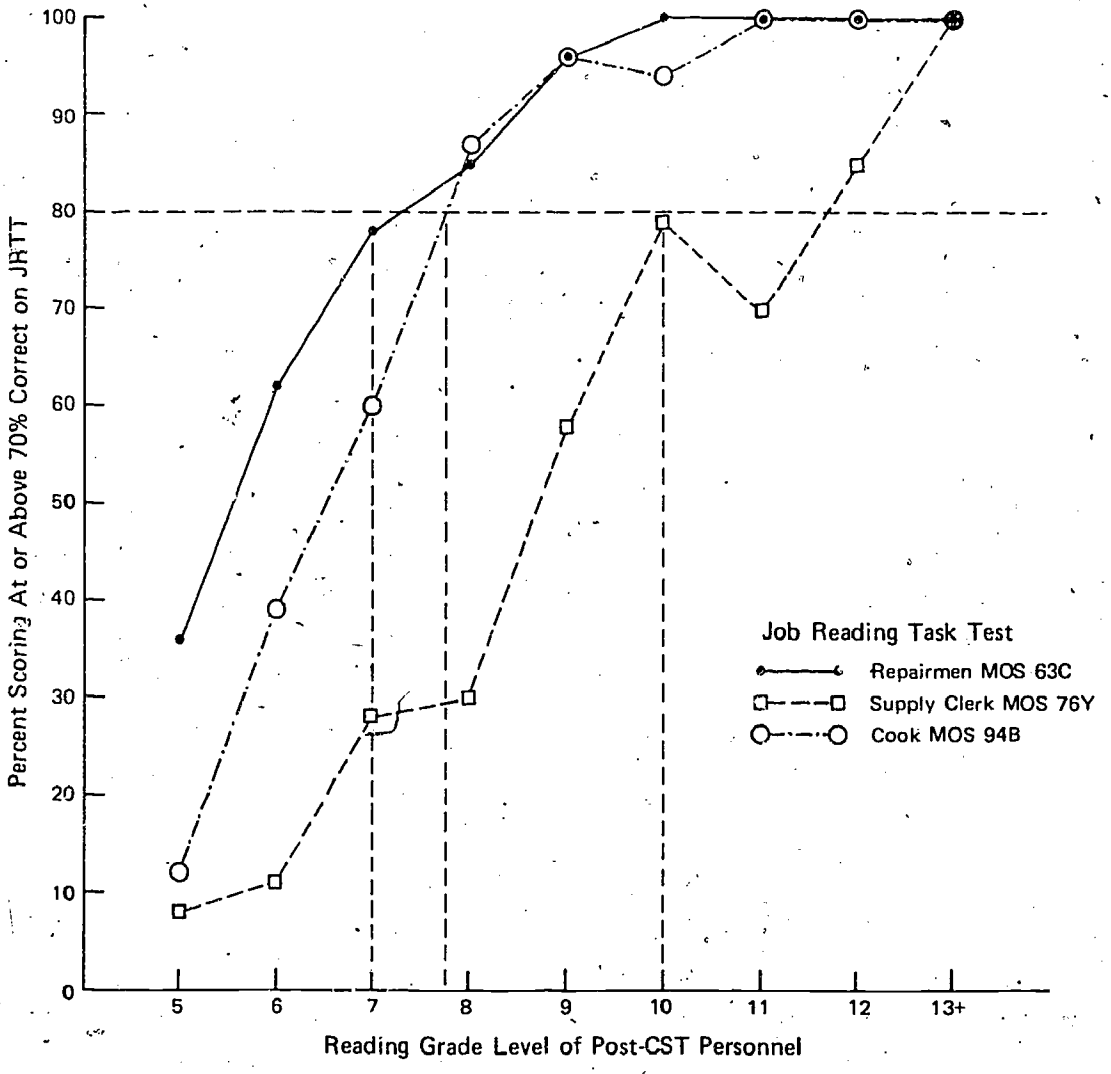


Figure 8

Chapter 5

DISCUSSION

This chapter presents a brief review of many of the manpower considerations and problems that led to the initiation of Work Units REALISTIC and READNEED. Certain conceptual and procedural problems in specifying reading requirements of jobs will be discussed, and four general approaches involving seven specific methods that have been used for problem assessment will be examined.

STRATEGIES FOR COPING WITH MARGINALLY LITERATE MANPOWER

Several strategies for coping with the problems of illiteracy (or low literacy) have been used by the Army, and other military services, at various times.

Nonacceptance of Illiterates. One way to overcome the problems resulting from low literacy skills in inductees is to avoid them. From time to time, the Army has raised its admittance standards with the result that large numbers of marginally literate men were excluded from service. In general, standards have been raised during intervals of relative military quiescence and lowered during periods of military activity, such as the Korean and Vietnam conflicts.

There are, however, several problems associated with the strategy of nonacceptance that limit its fruitfulness. For one thing, as with many other abilities, it is not a simple matter to accurately assess a man's literacy skills at the selection station. Hence, large numbers of potentially useful men may be turned away, while some who are not useful may be accepted.

The problem of accurately selecting men on the basis of their literacy skill is compounded by the fact that, until the present research, no attempt had been made to accurately identify literacy skill levels required by Army jobs and training schools. Therefore, there were no adequate criteria for selecting cutoff points on selection tests.

Both of the foregoing problems are concerned with assessment—the first with assessing the man, and the second with assessing the job requirements. A third problem affecting the usefulness and desirability of the strategy of nonacceptance concerns training. Manpower needs are such that it may become necessary, under conditions of large-scale mobilization, to enlist marginally literate men. If these men are not accepted during peacetime and the training methods needed to keep pace with technological change developed to effectively train such men, then new training techniques and methods will have to be developed under the stress of mobilization, when expediency and not effectiveness, may be the predominant training motive.

Perhaps the most significant results of the nonacceptance into the Army of men who are marginally literate is that a large and needy segment of the population is not able to reap the benefits of the training, education, social development, and practical experience that accompany Army service. This problem was underscored in the sixties by the initiation of two Department of Defense projects. In Project 100,000, announced in 1966, all the services accepted individuals scoring in the lower half of Mental Category IV on the Armed Forces Qualifications Test (AFQT).[1] In Project TRANSITION, initiated in

[1] Men in Mental Category IV have AFQT scores of 10-30.

1967, the military services provided in-service training and education to low-aptitude (and other) servicemen in order to prepare them for return to civilian life.

Remedial Training. A second strategy sometimes used by the Army, and the other services, in an attempt to solve the problems resulting from low literacy is to provide remedial training in reading. These training attempts have been thoroughly critiqued in the Department of Defense review of marginal men (14). That review indicates that literacy training, for the most part, has been ineffective in improving the on-the-job performance of low-aptitude men. It should be mentioned, however, that those literacy training programs did not have recourse to the improved technologies in instruction currently available. Remedial training now might be made more effective in improving literacy skills enough to reflect such improvements in job performance.

A further limitation to the remedial training programs mentioned is that they were not directed toward using literacy skills in a given job, but were geared to the attainment of general fourth-grade levels of reading skill and limited military vocabulary. Remedial training programs currently in progress are directed at the attainment of fifth-grade levels of literacy skills. However, since there has been inadequate knowledge of literacy skill levels necessary to satisfactorily perform given Army jobs (including training courses), remedial training objectives could not be and, as the present research indicates, were not stated accurately.

Limited Assignments. The problem of using marginal literates also has been dealt with by assigning these men to MOSs that have "minimal" requirements for reading. This strategy has not worked well (14) for two reasons. First, as with the other strategies reviewed, adequate definitions of the requirements for reading skills in different jobs have not been available; hence, it has not been possible to accurately state "minimal" requirements for reading skills.

A second difficulty is concerned with selecting job proficiency levels for establishing reading requirements. Individuals qualified for entry-level jobs are not necessarily qualified for advanced level jobs, yet in most instances advanced-level job positions are filled with personnel from the entry-level jobs. The assignment of a man with the marginal requirements needed for an entry-level job may result, perhaps because of combat casualties, in his promotion to a leadership position, with possible devastating effects for him and the men he leads.

Another difficulty with the policy of assigning the marginally literate to an MOS having relatively low requirements for literacy and arithmetic skills concerns the overall effectiveness of an MOS. This may be reduced if the MOS becomes flooded with marginals. Therefore, some means are necessary for distributing these men equitably among the suitable MOSs and the jobs within MOSs.

Modification of Training and Job Requirements. A fourth strategy for dealing with the problems of low literacy skills is to redesign training and job materials to minimize the importance of such skills. Under this strategy, training schedules and practices may be modified to meet the skill levels of different individuals. Thus, written instructional material may prove adequate for certain individuals, but the same instructions might best be presented in some other way for individuals having relatively low reading-skill levels. HumRRO Work Units APSTRAT, SPECTRUM, and EVATP have studied problems of individualized training techniques, and the development of training techniques especially effective with lower-aptitude men.

Although training courses can be modified to reduce the need for literacy skills, it should be noted that if a job requires a certain level of reading skill, then training that deemphasizes such reading is unrealistic and inadequate. Since the literacy skill levels necessary for satisfactory job performance in different MOSs have not been known, the minimal levels of reading difficulty in written materials that permit the satisfactory accomplishment of a job have been undefinable.

As with the other strategies, literacy skill levels of men must be identified so that these men can be assigned to training courses and be provided with training techniques appropriate to their needs. There is also the problem of specifying the skill levels required by the training and job materials in order to establish the necessity for redesign, and to establish the skill levels required by the redesigned materials.

ASSESSING JOB READING REQUIREMENTS

A problem common to the four strategies reviewed is that of defining skill-level requirements for jobs. For knowledgeable implementation of any one of these courses of action, information about the literacy skill levels necessary for successful job performance is necessary. Obtaining such information formed the primary basis for the initiation of Work Units REALISTIC and READNEED. In accomplishing these Work Units, four general approaches for assessing literacy demands of jobs have been considered. In the following paragraphs, each of these is discussed briefly.

ESTIMATE BASED UPON JUDGMENTS OF GENERAL EDUCATIONAL REQUIREMENTS

One approach for estimating reading demands of jobs is that used by the U.S. Department of Labor. Job analysts estimate the level of General Educational Development (GED) required for various jobs, based upon interviews with job incumbents, supervisors, and observation of the job being performed. A job may be categorized into any one of six GED levels, developed to roughly parallel school-based educational development (e.g., a GED of level 1, is said to approximate the education obtained in grades 1-3, and level 2 parallels 4-6th grade education, 15), and a job assigned a GED level can be said to have been assigned a reading grade level. This approach to assessment of reading requirements of jobs is a *judgmental* approach that calls for an estimate by the job analyst. Reading grade levels assigned by this method to eight Army MOSs studied in REALISTIC and READNEED are given in Column 5 of Table 18.

ESTIMATES GIVEN IN SUMMARY TASK STATEMENTS

A second approach to establishing literacy demands of jobs, and the approach currently used by military job specialists, is the summary task statement. In this approach, supervisors or job analysts prepare a summary statement of the tasks to be performed, in the form: "requires ability to read technical manuals," or "must have verbal ability to read simple forms and records." Such statements give no indication of a specified level of general reading skill required by the job. Examples of these statements from Army Regulation 611-201[2] are given in Column 2 of Table 18.

Both of the foregoing methods rely upon a job analyst or other responsible person to make a summary *estimate* of a job's reading demands without the use of a carefully articulated statement of the rules to be followed in arriving at this estimate, and without objective validating observations. For this reason, one may question the accuracy and appropriateness of such estimates.

[2] *Enlisted Military Occupational Specialties*, AR 611-201, 5 Jan 67.

Table 18

Reading Requirements of MOSs Determined by Seven Different Methods

MOS	Stated Requirement in AR 611-201[a]	DOT Code	DOT/ GED	DOT/ RGL	Readability	CTB[b]/ Job Know.	CTB/ Job Sample	CTB/ JRTT	USAFI/ MOS/ET
1	2	3	4	5	6	7	8	9	10
11B Light Weapons Infantryman	Requires verbal and reasoning ability to read and understand communications received, make appropriate disposition, or initiate necessary action. Requires reading and vocabulary aptitude to absorb, comprehend, and convey tactical and technical data involved in combined arms combat operations.	–	–	–	11[c]	–	–	–	7.5
11E Armor Crewman	Requires verbal and reasoning abilities to absorb, comprehend, and convey tactical and technical data involved in combined arms operations, and to read and understand communications received, make appropriate disposition, or initiate necessary action.	–	–	–	11[d]	8	8	–	–
26D Ground Control Radar Repairman	Requires verbal ability to read and understand technical material pertinent to function and maintenance of equipment serviced.	823.281	4	9-12	12+	–	–	–	–
31E Field Radio Repairman	Requires verbal ability to read and understand technical material pertaining to maintenance of field radio equipment.	720.281	4	9-12	–	–	–	–	9.8
63B, C Ground Vehicle Repairman	Requires verbal and reasoning ability to read and understand technical material pertaining to equipment being maintained and to apply diagnostic procedures to maintenance tasks.	620.281	4	9-12	11[c]	8	8	7	<7

(Continued)

Table 18 *(Continued)*

Reading Requirements of MOSs Determined by Seven Different Methods

MOS	Stated Requirement in AR 611-201[a]	DOT Code	DOT/ GED	DOT/ RGL	Readability	CTB[b]/ Job Know.	CTB/ Job Sample	CTB/ JRTT	USAFI/ MOS/ET
71H Personnel Specialist	Requires verbal and reasoning abilities to read, interpret, and apply regulations, directives, and manuals, and to interview and counsel individuals. Requires perceptual speed to review records and reports for accuracy and completeness.	205.368	4	9-12	12+[c]	–	–	–	9.8
76Y Unit & Organization Supply Specialist	Requires perceptual speed to scan and check supply forms and property record books for complete and appropriate entries.	223.387	3	7-8	1[c]	9	9	10	8.1
91B Medical Specialist	Requires ability to requisition supplies, and review, consolidate, and prepare technical, personnel, and administrative reports.	354.878	3	7-8	11[c]	–	–	–	8.6
94B Cook	Requires verbal ability to draft correspondence and reports on food service activities and results of inspections and surveys.	313.381	4	9-12	9[d]	7	7	7	–
95B Military Policeman	Requires verbal ability to interview witnesses and interrogate suspects, prepare written reports of findings, and read communications.	375.268	3	7-8	11[c]	–	–	–	<7

[a] *Enlisted Military Occupational Specialties,* Army Regulation 611-201, 5 Jan 67.
[b] CTB-California Test Bureau Survey of Reading Achievement, Junior High Level.
[c] FORCAST Index.
[d] Modified Flesch Index.

READABILITY ESTIMATES OF JOB READING DEMANDS

The development of readability formulas (Chapter 2) has made possible a third method for the assessment of the reading demands of jobs. By applying a readability formula to samples of job reading materials, an average reading grade level for the materials can be computed, and used to represent the reading requirements of the job. This is an objective, mechanical procedure, although it may not always be possible to obtain a representative sample of job materials, or even to determine the proper domain of materials from which sampling should be done. In this regard, a major difficulty can arise because of the distinction between the formal job task specifications and the actual, or informal job tasks that are performed on a day-to-day basis. If supervisors, management, or content experts are consulted to find out what reading materials a man must use in doing his job, they are likely to base their statements upon their conception of the formal, or even idealized job, and to prepare a list of materials which exceed reasonable expectations and which are, in fact, not used in the work-day activities. This situation was encountered in REALISTIC, where, in the Cook's MOS, materials reported by job incumbents as having been read in their work differed considerably from the materials identified by supervisors as being *the* job reading materials.

Reading requirements determined by readability analyses are presented for 10 MOSs in Column 6 of Table 18. Materials for the Cook's MOS were identified by interviews with job incumbents. The remaining readability estimates are based upon formally prescribed materials to be read for MOS proficiency qualification. The reading grade levels (RGL) given are rounded medians. In general, readability estimates appear to set reading levels higher than the other methods do. This probably occurs, at least in part, because the formally prescribed reading materials *are* very difficult and demand high levels of reading skills for effective use. The Cook's MOS, on the other hand, represents what men use on the job. This material has a lower reading difficulty level than materials sampled that were suggested by supervisors (grade 9.0 vs. grade 11.0).

ESTIMATES BASED ON TESTING OF PERSONNEL

A fourth general method for estimating job reading requirements, and the method constituting the bulk of the REALISTIC and READNEED research, is the traditional psychometric model for validating selection and classification tests. In this procedure, performance on a reading predictor test is related via correlational techniques to performance on a job proficiency criterion test. If the relationship is high enough, cut-off scores on the predictor variable can be selected to maximize the probability of obtaining personnel who will reach an acceptable level of proficiency.

There are two formally recognized procedures for making this analysis. One procedure is to measure the literacy skills of potential employees, then to employ all these persons and wait and find out who the successful performers are. The relationship between the original measures of literacy and the probability of being a successful performer is then determined, and a required literacy level can be established at the level that predicted successful job performance. This is the "predictive validity" psychometric model. While this is a powerful approach to the problem, it has the major drawback of requiring a considerable time between the administration of the literacy tests and the subsequent assessment of job proficiency. It is also frequently difficult to convince employers to hire all the job applicants so that subsequent failures can be detected.

A somewhat less satisfactory, but more expedient procedure is to use the "concurrent validity" psychometric model. Under this approach, job incumbents are administered both literacy tests and job proficiency tests in close temporal proximity. Scores on

the literacy test are then related to scores on the job proficiency measures as in the "predictive validity" model. The major drawback to this approach is that the job incumbents are, by virtue of being on the job, "successful"; the poorest job enrollees will have departed, and one is left with a higher level sample. If literacy is, in fact, related to job proficiency, then it is likely that men of very low levels of literacy will have been removed from the job ranks. For this reason, the relationships determined by the concurrent validity model may be attenuated. However, because of the convenience of this approach, it was followed for most of the REALISTIC and READNEED research.

In applying either of the foregoing psychometric models, major decisions are encountered in selecting the measures of literacy and job proficiency. In the REALISTIC research, we had first to define what was meant by literacy. While it is clear that this refers to the ability to read, this ability is an admixture of skills involved in decoding written symbols to some internalized representation, and skills and knowledges involved in language comprehension and use. Thus, one might be "illiterate" in the sense of being unable to read (decode), but be "literate" in the sense of knowing the language base upon which the written word is built. On the other hand, one can be "illiterate" in both senses—lacking decoding skills *and* language skills and knowledges. In REALISTIC, in an attempt to accommodate the first type of "illiteracy," literacy was assessed using a nonreading, listening test. In the READNEED research, literacy included only reading performance, with no attempt at separate assessment of nonreading language capabilities.

A second category of problems involved measuring job proficiency. In stating general literacy demands of jobs, it would seem desirable to measure job proficiency in terms of the tasks in the job that involve reading. One could then construct tests involving these tasks, and the performance on them can be related to the performance on the general reading tests. However, as mentioned earlier,[3] many important job tasks make no immediate demands upon reading skills; rather, they have an indirect need for such skills. For instance, preparing scrambled eggs makes no immediate demands for literacy skills, but knowing *when* and *how* to prepare scrambled eggs does—the cook must read the bulletin board to know that eggs should be prepared that day, he must read the master menu, and so forth. Therefore, job tasks can be defined in terms of the immediacy and directness of the demands for reading skills. Some tasks (e.g., filling out supply forms) are inherently reading tasks; others (e.g., setting the spark plug gap in a jeep) may have an indirect demand for reading—the mechanic may use a technical manual during his school training to learn how to adjust spark plugs, and then never refer to the manual again. Other tasks may be learned completely by "show-and-tell"—making no demands upon reading, but involving learning by listening.

Because job tasks may make more or less immediate and direct demands upon reading, the REALISTIC and READNEED research has examined relationships of reading ability to four different types of job proficiency involving tasks that vary in their demand for reading. In both REALISTIC and READNEED, relationships between reading ability and performance on Job Reading Task Tests (JRTT) were examined (READNEED, Chapter 4). In READNEED, relationships were examined between reading ability and proficiency on the Primary Military Occupational Specialty/Enlisted Evaluation Test (MOS/ET, Chapter 3). In REALISTIC, reading ability was related to performance of experienced job incumbents on two indices of job proficiency: job knowledge, paper-and-pencil tests, and job sample performance tests, in which men performed four to five hours on simulated job tasks.[4]

[3] In "Development of Job Reading Task Tests," Chapter 4.

[4] In both REALISTIC and READNEED, relationships between reading ability and supervisor ratings were examined. In neither case was the relationship sizable enough to warrant further consideration.

Thus, in the combined READNEED and REALISTIC research, there are four criterion measures of Army job proficiency. The JRTT reflects proficiency in reading the materials reported by job incumbents in three MOSs to be those that they actually used in doing their job. They are thus *direct* measures of ability to read and use Army printed materials. The JRTT are much like a standardized reading test, except that they contain Army material and they ask the questions that the job incumbents reported asking. The job knowledge and MOS ET tests also make an immediate demand upon reading ability, but, in addition, they require job knowledge for their satisfactory completion. The job sample tests make little or no *direct* demands upon reading ability (excluding the Supply Clerk's MOS), except when men chose to use the available TMs.

SELECTING A METHOD FOR ESTIMATING ARMY MOS READING DEMANDS

Which of the seven methods listed in Table 18 should be used to determine reading requirements of Army MOSs? So far as we know, there is no means other than rationalized human judgment for selecting one method over the other. An answer depends, in part, upon the purpose to be served, and the cost in time, money, and personnel, that one is willing to pay. While there is no unique, finite solution to the problem of selecting the best method for determining reading demands, certain features of the various methods can be made explicit, to ensure that they will be considered when one or the other method is contemplated.

SUMMARY TASK STATEMENTS

While the method of summary task statements (Table 18, Column 2) is low cost, it appears inadequate for any but the most gross screening of input. Without knowing what materials are to be read, the level of reading ability needed to read and understand them is indeterminate and unmeasurable.

DOT RGL METHOD

The DOT RGL estimate (Table 18, Column 5) is also relatively low in cost, but it appears insufficient on several counts for the purpose of determining with useful precision Army job reading requirements:

(1) For Army combat MOSs, there are no equivalent civilian jobs and the general military-civilian correspondence of jobs must be judgmentally estimated.

(2) Literacy requirements in the applicable range are specified in categories so broad as to permit only the coarsest differentiation.

(3) The literacy requirements estimated by this method (such as RGL 9-12 for jobs needing GED level 4) refer to the average or typical overall curriculum content taught in those school years, rather than to a measured level of reading ability.

(4) There is no statement of the contemplated level of job proficiency for either military or civilian jobs.

(5) Since the current source of DOT codes for Army MOSs provides several alternative DOT codes referring to civilian jobs to which the Army MOS is roughly analogous, selection among those codes is done on a judgmental basis and, once accomplished, encounters all the problems listed above.

FIVE EMPIRICAL METHODS

In sharp distinction to the DOT-RGL procedure, the five empirical methods (Table 18, Columns 6 to 10) of REALISTIC and READNEED yield a full statement of the relationship between all levels of literacy skills and all levels of some measure of job proficiency. The nature of the relationship is empirical and the data from which it is derived are described and subject to verification and extension to other MOSs. Given data on the relationship between measures of reading and job proficiency, the specification of the reading requirement for an MOS becomes directly dependent upon the level of job proficiency specified: the higher the job proficiency standard, the higher the reading requirement and vice versa. The judgment as to what level of job proficiency is good enough rests squarely with Army management. Without this judgmental decision about the target level of job proficiency, the reading level required for that job is indeterminate

Each of the five empirical methods (Table 18, Columns 6, 7, 8, 9, and 10) for determining job reading requirements uses a different criterion measure of job proficiency. At present, rationalized human judgment appears to be the only method available for selecting one criterion over the other as *the* measure of job proficiency. The judgment, however, is crucial, because, as indicated in Table 18, reading requirements may change depending upon the criterion definition of what level of which performance dimension constitutes satisfactory job proficiency.

For want of an authoritative specification of reading material that had to be understood for criterion-level job performance, the set of job information source materials listed in the DA PAM 12- Series for each MOS was adopted in the READNEED research. Systematic samples of reading passages from these sets clustered heavily at the 11th and 12th grade reading difficulty level for each of the seven MOSs studied. This reflected the preponderance of materials specified for the formal definition of the job, but these were too difficult to be used by most job incumbents. Our working decision to set the MOS reading requirement at the reading level for the easiest-to-read half of the passages was an arbitrary criterion standard. Considered abstractly, a job reading requirement at this level does not seem too demanding—but that is so only for reading materials that are necessary for realistically attainable, satisfactory job proficiency, not for an idealized total job mastery criterion. Certainly the DA PAM 12- Series seems an overly inclusive and demanding specification of printed materials that must be read and comprehended in order to perform these jobs satisfactorily.

Readability Method

Given an authoritative, competent, responsible criterion specification of just those job reading materials that *must* be readable with comprehension in order to perform the job in a reasonably satisfactory manner, the *readability* method would seem to be an appropriate one for determining MOS reading requirements. Setting the minimum criterion list of job reading materials is a difficult task; however, implementation needs are minimal, requiring only clerical time to count the one-syllable words in passages sampled from the criterion materials list. Given a listing of what must be read, the readability procedure will easily specify the level of reading ability needed.

Because of the difficulty in getting agreement on a minimal set of essential job reading materials, the FORCAST readability formula could be put to interim use in determining the readability of the separate and more limited reading materials used in MOS entry-level training courses. While these do not constitute the total body of job reading materials, they do constitute a common core of the most basic reading materials for the job, and it would be instructive to know the range of reading requirements imposed at this stage of formal, introductory job training.

Job Knowledge and MOS/ET

The *job knowledge* method (Table 18, Columns 7, 10) is a standard, straightforward approach to determining the MOS reading requirements that can readily be adapted to use existing personnel data. In the basic paradigm (REALISTIC, Table 18, Column 7), it calls for preparation of a job knowledge test for the MOS and administration of this and a standardized reading test to a full range sample of job incumbents. The reading grade level requirements reported were obtained from empirical data and for the criterion, asserted by the researchers, that defined satisfactory job knowledge as the 25th percentile of job knowledge for the sample of job incumbents.

The more administratively feasible variant of this method (READNEED, Table 18, Column 10) used the MOS/ET and the official minimum passing test score for the criterion definition of job knowledge proficiency and the AFQT for an estimate of reading grade level. Since these measures already exist in Army data banks and since the AFQT-RGL relationship is stable and need not be repeated, this procedure is easily applicable to any and all MOSs. An elementary computer program for ascertaining the lowest AFQT level at which MOS/ET scores meet the existing criterion point, and for a fixed linear transformation of that AFQT level to a RGL estimate, would produce a simple and inexpensive means of establishing the RGL requirement for any MOS for which the existing AFQT and MOS/ET data occur on a common data tape.

The illustrative MOS reading requirements generated by this method are keyed to the minimum passing test score criterion set by the proponent agency for the MOS in conjunction with the Enlisted Evaluation Center. The necessarily judgmental establishment of these criterion cutting points is based upon a variety of considerations involving personnel and manpower policies, although not all are germane to the purpose of defining target levels of job proficiency. For the primary purpose of establishing realistic objectives and target levels of job-knowledge proficiency for an MOS, it would seem appropriate to set the criterion cutoff point for this purpose independent of other factors.

It should be noted that any written job knowledge test requires both general reading ability and specific job knowledge. The man taking the test must read the multiple-choice questions about the content of the job material. Inability to read and understand the question disables him from showing whether or not he possesses that item of job knowledge. The consistent substantial relationship between reading ability and job knowledge measures (predictive and concurrent validity $r \cong .6$ in CST and concurrent validity $r \cong .5$ in job incumbents) indicates the importance of general reading ability. Whether people who have learned to read better also tend to acquire most job knowledge in formal training programs and in on-the-job experience, or whether general reading ability merely sets limits to the amount of job knowledge that can be manifested in a written test is a moot question in these data.

Job Sample Method

The *job sample* method (Table 18, Column 8) is an empirical procedure using as criterion variable the hands-on performance on an extensive sample of individually administered job tasks. Except in the case of the Supply MOS where the job tasks are predominantly reading tasks, this criterion makes no direct demand upon reading but is presumably affected by internalized job knowledge acquired, to an unknown extent, through prior reading. As with the REALISTIC job knowledge method, the criterion point was judgmentally selected to include the 75% of job incumbents scoring highest on the hands-on performance measure.

Although the job sample performance measure is less highly related to reading ability than are the more verbal measures of proficiency, this method, in conjunction with the criterion cutoff assumed by the researchers, yields MOS reading requirement

levels that appear reasonable. However, the costs of constructing and administering an extensive job-sample test to a representative sample of job incumbents in an MOS seem prohibitive for all but fundamental research purposes.

Job Reading Task Method

The *job reading task method* (Table 18, Column 9) represents the most direct empirical approach to determining MOS reading requirements in that it takes as its criterion measure the reading score on the JRTT, a sample of actual, and commonly used, job reading materials. To the extent that the job reading passages constituting the JRTT comprise or represent all the reading tasks of the MOS, the ability to read the JRTT passages *is* the ability to perform the job reading tasks and thus to meet the MOS reading requirement.

As with the readability method, the problem with the JRTT method is that of obtaining a listing of the materials that must be read in order to achieve satisfactory job proficiency. In the present research, reading passages were selected for the JRTT from the printed materials that the job incumbents remembered reading during the previous month. Thus, the JRTT comprises the material most frequently reported by incumbents as being used in the day-to-day job performance.

Under this method, the reading requirement for an MOS is set as the lowest reading grade level at which criterion performance on the JRTT is reached. Making allowance for measurement error and the subjects' limited job experience, the criterion of job reading proficiency was taken as the point at which 80% of the Post-CST subjects passed at least 70% of the JRTT items. Illustrative MOS reading requirements associated with this criterion level are presented in Table 18, Column 10.

Preparation and administration costs for the JRTT are substantial in that high-usage job reading materials must be determined by interview and observation, and both the resulting JRTT and a reading measure must then be administered to a representative sample of job incumbents in that MOS. The relationship ($r = .78$) between general and job task reading ability suggests a considerable commonality to these two reading measures. For the general purposes of determining MOS reading requirements, the cost and effort of preparing MOS-specific reading tests offers no apparent advantage beyond the sometimes important factor of high face validity.

SUMMATION

In summary, it must be explicitly recognized that the readability, job-knowledge, job-sample, JRTT, and PMOS/ET measures of job proficiency are incommensurate; no single heuristic decision rule for establishing a meaningful comparable cut-off level of satisfactory job proficiency has evolved for the five different methods of measuring job proficiency.

Each method provides a set of reading-requirement levels coordinate with a set of job-proficiency levels. Each method uses a different measure of job proficiency, and for four of the five such measures a different arbitrary criterion level was set to provide an illustratively finite reading requirement value for that method. For each method, setting a different, judgmental, proficiency-criterion level results in a different job-literacy-requirement level. Accordingly, these different methods would specify the same reading requirement for a job, only to the extent that the different criterion cutoff points judgmentally set on different job-proficiency dimensions, all represented equal literacy requirements.

The REALISTIC and READNEED research presents general methods and a full range of data for determining the MOS reading requirements for any specified criterion level of job performance in that MOS. Specific examples of the outcomes of the application of these procedures have been presented for several MOSs in Table 18, Columns 6 to 10. Each of the specific reading requirement values presented in this table depends on the job-performance-criterion level adopted through the arbitrary judgment of the researchers for illustrative purposes. Therefore, these values should be expected to be comparable only to the extent that informed policy judgment agrees with the present choice of criterion levels of job performance as representing the Army's definition of satisfactory job performance.

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AND
APPENDICES

LITERATURE CITED

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Appendix A

EXPERIMENTAL PASSAGES

Passage 11

Going into the prone position:

Hold your weapon under one arm and crouch slowly. Feel for the ground with your free hand and make sure it is clear. Lower your knees, one at a time, until your weight is on your knees and free hand. Shift your weight to your free hand and opposite knee. Raise your free leg up and back and lower it gently to the ground, feeling with your toe for a clear spot. Roll gently to that side and move your other leg into position the same way. Roll quietly into the prone position.

Crawling:

The low crawl and high crawl are not suitable when you are very near the enemy. They make a shuffling noise which is too easily heard. Crawl on your hands and knees. Lay your weapon on the ground by your side. With your right hand, feel for or make a clear spot for your knee.

Passage 12

Use of the Military Police Club:

The military police club is used only in circumstances in which it is fully justified. Learn through practice to use the club in your left hand. This leaves your right hand free to handle your firearm in case of necessity. Never take the club from the belt for use except in an emergency.

Holding the club:

To hold the club, place the thong over the left thumb, across the back of the hand, and grasp the grip. If the thong proves to be too large, turn the club in your hand after the grip is completed until the thong is tight across the back of your hand. If the club is held in this fashion, your hand does not become bound to the club if an attempt is made to pull you off balance by pulling at the club. The club normally is used as an extension of the arm.

Passage 13

Application of Pressure Dressing:

The application of a sterile dressing with pressure to a bleeding wound helps clot formation, compresses the open blood vessels, and protects the wound from further invasion of germs. The following procedure should be used when a person is wounded.

Look for more than one wound. For example, a missile may have come out at another point. The wound where a missile comes out is usually larger than the one where it enters.

Cut the clothing and lift it away from the wound to avoid further contamination. Tearing the clothing might result in rough handling of the injured part. Do not touch the wound; keep it as clean as possible. If it is already dirty, leave it that way. Do not try to clean it in any way.

Cover the wound with a first aid dressing and apply pressure to the wound by use of the bandages attached to the dressing.

Passage 14

Range mark gate multivibrator Q1 and Q2 produces a 500-microsecond negative gate which is delivered to blocking oscillator Q3 and inverter Q4. The gate delivered to blocking oscillator Q3 is differentiated prior to arrival. The pulse corresponding to the leading edge is used to trigger blocking oscillator Q3, which, in turn, produces the touchdown marker. The touchdown marker is later inserted at the start of the range mark train in place of the first range mark (which was deleted by the range mark cancel pulse). Inverter Q4, which receives the complete range mark gate, has two outputs. One output, the inverted range mark gate, is applied to switch Q5. Upon reception of the range mark gate, switch Q5 gates-on free-running range mark multivibrator Q8 and Q9. Simultaneously, a negative spike corresponding to the leading edge of the range mark gate is developed at inverter Q4, and applied through the RM POS variable resistor and emitter follower Q6 to the range mark multivibrator.

Passage 15

Adequate protection from the elements and environmental conditions must be provided by means of proper storage facilities, preservation, packaging, packing, or a combination of any or all of these measures. To adequately protect most items from the damaging effects of water or water-vapors, adequate preservation must be provided. This is often true even though the item is to be stored in a warehouse provided with mechanical means of controlling the temperature and humidity. Several methods by which humidity is controlled are in use by the military services. Use is also made of mechanically ventilating and dehumidifying selected sections of existing warehouses. Appropriate consideration will be given to the preparation and care of items stored under specific types of storage such as controlled humidity, refrigerated, and heated. The amount and levels of preservation, packaging, and packing will be governed by the specific method of storage plus the anticipated length of storage.

Passage 16

Radio interference suppression is the elimination or minimizing of the electrical disturbances which interfere with radio reception, or disclose the location of the vehicle to sensitive electrical detectors. It is important that vehicles with, or without radios be properly suppressed to prevent interference with radio reception of neighboring vehicles.

The ignition and generating systems have been designed to suppress radio interference. Ignition system interference suppression is effected by a primary capacitor

in the distributor wiring harness receptacle, a resistor suppression in the spark plugs, and by shielded spark plug cables. Radio interference suppression in the generating system is effected by a choke, capacitor, filter and rectifier in the generator regulator assembly. The primary capacitor is housed in the distributor wiring harness receptacle and is an integral part of the primary circuit. Spark plugs are shielded individually by metallic braid beneath the rubber insulation. The generator regulator assembly houses the capacitor, choke, filter and rectifier.

Passage 21

If you do not have a compass, you can find direction by other methods.

The North Star. North of the equator, the North Star shows you true north. To find the North Star—

Look for the Big Dipper. The two stars at the end of the bowl are called the "pointers." In a straight line out from the pointers is the North Star (at about five times the distance between the pointers). The Big Dipper rotates slowly around the North Star and does not always appear in the same position.

You can also use the constellation Cassiopeia. This group of five bright stars is shaped like a lopsided M (or W, when it is low in the sky). The North Star is straight out from the center star about the same distance as from the Big Dipper. Cassiopeia also rotates slowly around the North Star and is always almost directly opposite the Big Dipper.

Passage 22

Service Headlights Adjustment.

Position vehicle on a level floor with no load in vehicle. Headlights should be 25 feet from a smooth vertical surface. Inflate tires to proper pressure.

Measure centerline of headlights from floor; draw a horizontal line at that height on the flat surface. Draw a second line parallel to and 3" below first line.

Draw a vertical line intersecting the first two lines at the projected centerline of the vehicle.

Measure distance between two headlight centers, then divide distance equally on both sides of centerline. Draw a vertical line at these points, intersecting the first two lines.

Turn headlights on and select high beam. Cover one light while adjusting the other.

Turn adjusting screws in or out until beam is adjusted to a pattern as near as possible to that shown in figure 2-213. Adjust other headlight in same manner.

Replacement of Sealed Beam Lamp.

Remove three screws and lockwashers.

Passage 23

The purpose of padding a cast is to provide more comfort for the patient, to lessen the possibility of pressure sores, and to make it easier and safer to remove the cast.

Stockinet may be used next to the skin as a padding material for a close-fitting and well-contoured cast. It should not be used alone for acute fractures, where there is excessive swelling, or immediately after an operation, since it tends to constrict and may impair circulation. If stockinet is used without additional padding, the fact should be

noted with indelible pencil on the cast, so that when the cast is removed the electric cutter will be used with caution.

Sheet cotton or webril bandage can be wrapped over the stockinet in one to three layers. It should be rolled on smoothly with the turns overlapping about one-half the width of the bandage.

Bony prominences are then padded with pieces of felt.

Passage 24

In order to draw valid inferences concerning the overall quality of stored material, the sample units selected for examination and testing should be representative of the "population" of supplies from which this sample has been drawn. The "population" may be a lot established at time of manufacture, a group of these lots similar in characteristics, or all the material stored under the same conditions. Selection of samples shall be accomplished in a manner that will assure that each unit in the lot has an equal chance of being included. That is, items must be selected without regard to their quality. Biased sampling methods must be avoided, such as selecting items from one location, selecting items that appear to be either good or defective, etc. Obvious defectives should be identified but not removed until the sample has been selected. Tables of random numbers, or similar devices, should be used for the selection process.

Passage 25

Rear area protection (RAP) encompasses two broad functions—rear area security and area damage control. Military police are primarily concerned with rear area security. The logical and normal deployment of military police elements in a combat area makes them ideal for RAP operations. Their areas of interest normally coincide with the enemy's area of interest. In addition, military police normally will be the first element to investigate an incident or to be on the scene. Their inherent mobility coupled with excellent communications provides a capability to construct rapidly an integrated RAP element on the spot.

Whenever possible, military police rear area security responsibilities are programmed to provide reconnaissance and escort platoons. This approach provides an area commander an essential tool for RAP operations and simultaneously provides military police with the minimum equipment to perform their reconnaissance and escort responsibilities. A detailed discussion of rear area protection will be found in FM 19-45-1.

Passage 26

Flagging action will be removed when the individual is undergoing punishment under Article 15 or during a suspension of such punishment imposed, when the commander has indicated that the nonjudicial punishment will be administered in a manner that will preclude its consideration in a possible promotion or other favorable action. Except as indicated above, flagging action will not be removed while an individual is undergoing punishment imposed under Article 15, UCMJ, or sentence of courts-martial, or during the term of any suspension of punishment imposed. An individual is considered to be undergoing punishment with respect to any forfeiture or detention of pay as follows:

When forfeiture or detention of pay has been imposed by sentence of court-martial, until the day following the last day of the period of forfeiture or detention of pay specified in the sentence of the court as finally approved, if all other portions of the sentence have been completely executed.

Appendix B

STRUCTURAL PROPERTY VALUES OF EXPERIMENTAL PASSAGES

Structural Property	Passage[a]											
	11	12	13	14	15	16	21	22	23	24	25	26
Number of sentences	14	9	12	8	7	8	11	14	6	6	9	4
Words per sentence	11	17	13	19	21	19	14	11	25	25	17	38
Number of independent clauses	18	10	15	8	7	8	11	17	6	6	9	4
Words per independent clause	8	15	10	19	21	19	14	9	25	25	17	38
Number of one-syllable words	124	122	106	91	79	68	114	93	99	87	68	78
Number of difficult words	15	18	21	51	49	70	18	33	37	46	74	48
Number of different difficult words	10	14	17	34	34	43	11	19	31	35	46	26
Number of different words	79	76	91	69	89	70	75	87	94	95	78	69
Number of three-or-more-syllable words	8	8	13	25	40	62	9	24	15	33	57	36
Total number of syllables	184	191	212	251	289	323	200	236	227	260	319	276
Total number of letters	608	604	664	730	819	894	631	741	692	748	862	774
Syllables per sentence	13	21	18	31	41	40	18	17	38	43	35	69
Letters per sentence	43	57	55	91	117	112	57	53	115	125	96	194
Number of words of seven or more letters	9	15	33	38	54	68	20	40	35	40	60	52
Number of different three-or-more syllable words	4	7	12	17	31	32	8	16	13	25	32	22

[a]Each passage contained 150 words.

Appendix C

DATA USED TO ASSIGN RGL SCORE TO EACH EXPERIMENTAL PASSAGE

This appendix presents the data used to assign a reading grade level score to each of the experimental passages. Data are presented for the 35% correct criterion level, used for the FORCAST index, and for the 30, 40, and 45% correct criterion levels for comparison purposes. For each passage, tabulated data show the percentage of subjects at each reading grade level scoring at or above the criterion level on the cloze test for that passage. The Ns indicate the number of subjects in each reading grade level who were tested on the set of six passages listed to the right of the N column and on whom the tabulated percentages are based.

Table C-1

Percentage of Subjects at Each Reading Grade Level Meeting Indicated Cloze Criterion

RGL	N	First Set of Passages						N	Second Set of Passages					
		11	12	13	14	15	16		21	22	23	24	25	26
30% Criterion Level														
12.0-12.9	35	100	100	97	40	89	83	25	100	96	96	68	80	88
11.0-11.9	50	96	98	98	38	70	58	49	96	86	94	63	57	51
10.0-10.9	17	94	94	100	29	53	59	14	100	79	93	50	57	64
9.0-9.9	14	100	93	100	36	50	57	27	93	56	70	44	22	33
8.0-8.9	26	88	81	96	4	31	19	30	100	63	77	30	23	23
7.0-7.9	13	77	85	69	23	31	8	15	100	60	73	13	20	27
6.0-6.9	14	50	71	64	14	7	0	12	75	25	33	0	0	25
5.0-5.9	14	43	50	36	7	0	0	12	67	8	8	0	0	8
Below 5.0	17	29	35	35	0	0	0	11	54	18	9	0	9	9
35% Criterion Level														
12.0-12.9	35	97	100	97	34	66	63	25	100	96	96	60	64	72
11.0-11.9	50	86	96	96	26	52	44	49	96	71	69	35	33	24
10.0-10.9	17	76	94	94	12	29	35	14	100	71	86	29	29	43
9.0-9.9	14	100	93	93	21	21	29	27	93	48	59	15	7	22
8.0-8.9	26	73	73	81	4	12	4	30	100	23	37	10	0	17
7.0-7.9	13	69	62	54	8	8	8	15	87	40	20	0	0	7
6.0-6.9	14	29	36	36	7	0	0	12	75	17	8	0	0	17
5.0-5.9	14	29	43	21	0	0	0	12	25	8	0	0	0	8
Below 5.0	17	12	24	12	0	0	0	11	36	0	0	0	0	9

(Continued)

Table C-1 *(Continued)*

Percentage of Subjects at Each Reading Grade Level Meeting Indicated Cloze Criterion

RGL	N	First Set of Passages						N	Second Set of Passages					
		11	12	13	14	15	16		21	22	23	24	25	26
40% Criterion Level														
12.0-12.9	35	97	100	97	31	54	46	25	100	92	92	52	60	68
11.0-11.9	50	80	96	96	10	34	32	49	94	65	55	26	24	14
10.0-10.9	17	71	94	94	6	18	24	14	100	64	79	[illegible]	14	21
9.0-9.9	14	93	86	93	21	21	14	27	93	41	52	0	4	18
8.0-8.9	26	54	69	73	4	12	0	30	97	23	23	10	0	10
7.0-7.9	13	62	62	54	8	8	0	15	80	20	7	0	0	7
6.0-6.9	14	21	36	29	0	0	0	12	58	17	8	0	0	17
5.0-5.9	14	14	36	21	0	0	0	12	8	0	0	0	0	0
Below 5.0	17	12	12	6	0	0	0	11	27	0	0	0	0	9
45% Criterion Level														
12.0-12.9	35	94	97	91	14	31	29	25	96	72	72	24	36	44
11.0-11.9	50	60	88	88	2	18	20	49	92	37	41	8	12	10
10.0-10.9	17	53	71	65	0	0	6	14	93	36	36	0	0	7
9.0-9.9	14	50	71	50	14	14	0	27	90	22	15	0	0	11
8.0-8.9	26	31	42	46	4	4	0	30	73	7	13	3	0	7
7.0-7.9	13	38	31	38	0	0	0	15	60	13	7	0	0	7
6.0-6.9	14	14	14	7	0	0	0	12	33	8	8	0	0	8
5.0-5.9	14	7	0	7	0	0	0	12	8	0	0	0	0	0
Below 5.0	17	6	6	0	0	0	0	11	18	0	0	0	0	9

Appendix D

MEAN PERCENT CORRECT CLOZE SCORE FOR CLOZE TEST VARIATIONS

Cloze Passage	Variation				
	1	2	3	4	5
11	35	57	41	38	53
12	45	47	43	50	49
13	50	51	48	39	40
14	24	17	15	24	17
15	31	27	32	23	23
16	18	27	27	22	32
21	54	52	62	51	51
22	35	40	35	25	32
23	31	40	36	34	34
24	25	20	33	20	21
25	27	18	28	24	18
26	17	24	25	40	18

Appendix E

MULTIPLE CORRELATIONS OF SELECTED SETS OF PREDICTORS WITH MEAN CLOZE SCORE

Predictor Sets[a]	*R*
Words per Sentence (2) + One-Syllable Words (5)	.87
Words per Sentence (2) + Difficult Words (6)	−.89
Words per Sentence (2) + Different Difficult Words (7)	−.89
Words per Sentence (2) + Polysyllabic Words (9)	−.82
Words per Sentence (2) + Total Syllables (10)	−.85
Words per Sentence (2) + Seven-or-more Letter Words (14)	−.81
Words per Sentence (2) + Different Polysyllabic Words (15)	−.84
Words per Sentence (2) + Total Syllables (10) + Total Letters (11)	−.85
Words per Independent Clause (4) + One-Syllable Words (5)	.87
Words per Independent Clause (4) + Total Syllables (10)	−.85

[a]Predictor variables are numbered in accordance with Table 4.

Appendix F

MANUALS AND REGULATIONS SAMPLED TO DETERMINE READING DEMANDS OF SEVEN MOSs[a]

Manuals	N
11B20 Light Weapons Infantryman	
TM 9-1340-214-12	7
TM 11-5805-201-12	3
TM 11-5855-203-13	8
FM 5-15	6
FM 20-32	7
FM 20-33	4
FM 21-26	12
FM 21-75	12
FM 23-8	3
FM 23-9	4
FM 23-12	5
FM 23-23	3
FM 23-30	3
FM 23-31	6
FM 23-65	11
FM 23-67	3
FM 23-71	3
FM 24-18	4
26D20 Ground Control Radar Repairman	
TM 11-5840-281-ESC	3
TM 11-5840-281-15	38
TM 11-5840-293-12	13
TM 11-5895-468-12	7
TM 11-5895-474-12	6
TM 38-750	11
63B20 Wheel Vehicle Mechanic	
TM 5-4310-26-15	3
TM 9-243	9
TM 9-2320-209-20	26
TM 9-2320-211-10	4
TM 9-2320-211-20	24
TM 9-2320-218-20	22
TM 9-2320-244-20	3
TM 10-3930-242-12	6
TM 21-305	4
TM 38-750	9
AR 310-1	3
AR 750-5	3
71H20 Personnel Specialist	
AR 55-46	3
AR 210-10	3
AR 310-1	3
AR 310-10	4
AR 340-15	7
AR 380-5	3
AR 600-10	3
AR 600-31	6
AR 600-200	7
AR 601-280	3
AR 606-5	3
AR 608-3	3
AR 611-101	3
AR 611-103	4
AR 611-112	3
AR 611-201	3
AR 614-200	3
AR 630-5	3
AR 635-200	3
AR 640-10	3
AR 672-5-1	3
AR 680-1	6
AR 680-20	3
DA Pam 600-8	3
DA Pam 608-2	3
DA Pam 611-1	4

Manuals		N
76Y20 Armorer/Unit Supply Specialist		
TM	55-4310-200-25P	3
TM	9-1005-223-20	3
TM	9-2820	3
TM	38-750	7
TM	743-200	4
FM	20-15	3
FM	21-11	3
FM	21-15	3
AR	210-130	4
AR	220-10	3
AR	310-1	4
AR	340-15	3
AR	340-18-1	3
AR	385-55	3
AR	700-84	6
AR	700-87	3
AR	735-11	5
AR	735-35	8
AR	746-10	3
AR	750-1	3
DA Pam	310-4	3
DA Pam	310-6	3
91B20 Medical Specialist		
TM	8-230	30
TM	8-231	3
TM	8-273	12
FM	8-35	5
FM	21-10	6
FM	21-11	12
AR	40-419	3
AR	40-425	3
AR	40-562	3
AR	600-6	3
AR	735-35	3
TB MED	246	3

Manuals		N
95B20 Military Policeman		
FM	19-4	3
FM	19-5	17
FM	19-10	7
FM	19-15	7
FM	19-25	10
FM	19-30	6
FM	19-40	5
FM	19-50	5
FM	20-32	3
FM	21-11	7
FM	21-26	10
FM	21-75	3
FM	22-5	4
FM	23-9	5
FM	23-31	3
FM	23-35	4
FM	24-1	3
FM	24-18	4
FM	27-10	6
FM	31-16	3
FM	31-23	4
AR	190-22	3
AR	190-45	3
DA Pam	360-530	7
	MCM	3
	TB PMG	3

[a]See Table 7.

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13. ABSTRACT

READNEED research was concerned with the development of methodologies for determining reading requirements of Army MOSs. Three approaches for assessing MOS literacy demands are described: (a) analysis of readability of Army MOS materials using a newly developed readability formula calibrated on Army personnel and Army job materials; (b) use of information currently in Army data banks to study relationships between reading ability (estimated from AFQT) and job proficiency (indexed by the Primary Military Occupational Specialty/Evaluation Test); and (c) direct assessment of personnel reading skills in relation to proficiency on specially constructed Job Reading Task Tests (JRTT). Feasibility studies that indicate the relative merits of each approach, and certain conceptual and operational problems in determining literacy requirements of jobs are described.

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Armed Forces Qualification Test						
Functional Literacy						
Job Analysis						
Job Materials						
Job Proficiency						
Literacy						
Project 100,000						
Readability analysis						
Reading analysis						
Technical manuals reading						

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2 CG US ARMY EUROPE APO 09403 NY ATTN OPNS DIV
1 CO ARMY TRANS RES COMD FT EUSTIS ATTN TECH LIB
1 CG USA AD COMD ENT AFB ATTN ADGPA COLO
6 CG 1ST ARMY ATTN DCSOT FT MEADE MD
1 CG 3RD ARMY ATTN DCSOT FT MCPHERSON
4 CG SIXTH ARMY PRES OF SAN FRAN ATTN AMOPS-T2
1 CG EUSA ATTN AG-AC APO 96301 SAN FRAN
1 OIR HEL APG MD
2 ENGNR PSYCHOL LAB PIONEERING RES DIV ARMY NATICK LABS NATICK MASS
4 TECH LIB ARMY NATICK LABS NATICK MASS
2 INST OF LAND CBT ATTN TECH LIB FT BELVOIR VA
1 CO FT HUACHUCA SPT COMD USA ATTN TECH REF LIB
1 SIXTH USA LIB DEPOT BLDG M 13 14 PRES OF SAN FRAN
5 CG FT ORD ATTN G3 TNG DIV
1 CO HQ ARMY ENLISTED EVAL CTR FT BENJ HARRISON
1 LIB DEF SUPPLY AGCY CAMERON STA VA
2 CO USA CDC AG AGCY FT BENJ HARRISON IND
1 CG ARMY CDC INF AGY FT BENNING
1 CO ARMY CDC ARMOR AGY FT KNOX
1 OIR OF INTERN TNG USA LOG MGT CTR FT LEE
3 CO USA [illegible] CTR (FA) ATTN AKPSITC-TT FT SILL
1 CG USA TNG CTR & FT LEONARD WOOD ATTN ACOFS G3
1 CG USA INF CTR ATTN AJIGT-T FT BENNING
1 CG USA TNG CTR INF ATTN ACOFS G3 FT DIX
1 CG USA TNG CTR ATTN ACOFS G3 FT JACKSON
1 CG USA TNG CTR INF ATTN ACOFS G3 FT LEWIS
1 CG USA TNG CTR INF & FT ORD ATTN ACOFS G3
61 CG USA TNG CTR INF ATTN ACOFS G3 FT POLK
5 CO USA MED TNG CTR ATTN OIR OF TNG FT SAM HOUSTON
20 CG USA AD CTR ATTN G3 FT BLISS
1 CG USA TNG CTR INF ATTN ACOFS G3 FT CAMPBELL
3 LIB ARMY WAR COLL CARLISLE BKS
1 COMDT COMD & GEN STAFF CO FT LEAVENWORTH ATTN ARCHIVES
1 DIR OF MILIT PSYCHOL & LDRSHP US MILIT ACAD WEST POINT
1 US MILIT ACAD WEST POINT ATTN LIB
1 COMDT ARMY AVN SCH ATTN OIR OF INSTR FT RUCKER
2 COMDT ARMY SECUR AGY TNG CTR & SCH FT DEVENS ATTN LIB
1 STIMSON LIB MED FLD SERV SCH BROOKE ARMY MED CTR FT SAM HOUSTON
10 COMDT THE ARMOR SCH ATTN DOI FT KNOX
1 COMDT USA CHAPLAIN SCH ATTN DOI FT HAMILTON
1 COMDT USA FIN SCH ATTN CHF DOC DEV LIT PLN DIV DOOI IND
1 USA FINANCE SCH FT BENJ HARRISON ATTN EDUC ADV
4 COMDT ADJ GEN SCH FT BENJ HARRISON ATTN EDUC ADV
1 COMDT USAIS ATTN EDUC ADV FT BENNING
1 COMDT USAIS ATTN AJIIS-D-EPRO FT BENNING
1 HQ US ARMY ADJ GEN SCH FT BENJ HARRISON ATT COMDT
1 LIB ARMY QM SCH FT LEE
1 COMDT USA QM SCH FT LEE ATTN EDUC ADV
1 COMDT ARMY TRANS SCH FT EUSTIS ATTN EDUC ADV
1 CO USA SEC AGY TNG CTR & SCH ATTN ATEV RSCH ADV FT DEVENS
1 COMDT USA MIL POLICE SCH ATTN PLNS &PROG DOOI FT GORDON
2 COMDT US ARMY SOUTHEASTERN SIG SCH ATTN EDUC ADV FT GORDON
1 COMDT USA AD SCH ATTN DOI FT BLISS
1 CO USA ORD CTR & SCH OFC OF OPS ATTN AHBN-O APG MD
5 ASST COMDT ARMY AIR DEF SCH FT BLISS ATTN CLASSF TECH LIB
1 COMDT DEF INTELL SCH ATTN SIGAS DEPT
1 COMDT ARMED FORCES STAFF COLL NORFOLK
1 COMDT USA SIG CTR & SCH ATTN DOI FT MONMOUTH
1 COMDT JUDGE ADVOCATE GENERALS SCH U OF VA
1 OPTY COMDT USA AVN SCH ELEMENT GA
1 USA AVN SCH ELEMENT OFC OF DIR OF INSTR ATTN EDUC ADV GA
1 EDUC CONSLT ARMY MILIT POLICE SCH FT GORDON
6 COMDT USA ENGR SCH ATTN EDUC ADV AHBBES-EA FT BELVOIR
2 COMDT USA SCH EUROPE ATTN EDUC ADV APO 09172 NY
1 OFC OF DOCTRINE DEV LIT & PLNS USA ARMOR SCH ATTN AHBAAS-DM
1 COMDT ARMY AVN SCH FT RUCKER ATTN EDUC ADV
1 DIR OF INSTR US MIL ACAD WEST POINT NY
1 DIR OF MILIT INSTR US MILIT ACAD WEST POINT
1 COMDT DEF MGT SCH FT BELVOIR
2 COMDT USA MSL & MUN CTR & SCH ATTN CHF OFC OF OPS REDSTONE ARSNL
2 COMDT US MAC SCH US MAC CTR ATTN AJMCT FT MCCLELLAN
2 HQ ABERDEEN PG ATTN TECH LIB
1 CO USA INTELL CTR & SCH ATTN DIR OF ACADEMIC OPS FT HUACHUCA
1 CO USA INTELL CTR & SCH ATTN DIR OF DOC & LIT FT HUACHUCA
1 COMDT USA C&GSC OFC OF CHF OF RESIDENT INSTR FT LEAVENWORTH
1 COMDT USA CA SCH ATTN OFC OF DOCTRINE DEVEL LIT & PLNS FT BRAGG
1 COMDT USA CA SCH ATTN DOI FT BRAGG
1 COMDT USA CA SCH ATTN LIB FT BRAGG
10 COMDT USA INST FOR MIL ASSIST ATTN DOI FT BRAGG
8 COMDT USA FLD ARTY SCH ATTN DOI FT SILL
1 COMDT USA TRANS SCH ATTN DIR OF DOC & LIT FT EUSTIS
1 COMDT USA TRANS SCH ATTN LIB FT EUSTIS
1 COMDT USA C&GSC ATTN ATSCS-DJ (SPWAR)
1 COMDT ARMY QM SCH OFC DIR OF NONRESID ACTVY ATTN TNG MEDIA DIV VA
1 COMDT USA ARTY SCH ATTN LIB FT SILL
1 CG USA SCH & TNG CTR ATTN ACOFS G3 FT GORDON
1 DIR OF GRAD STUD & RSCH ATTN BEHAV SCI REP USA&&GSC
1 COMDT USA AD SCH ATTN AKBAAS-OL-EA FT BLISS
1 CG USA SIG CTR & SCH ATTN ATSSC-OP-COB FT MONMOUTH
1 SECY OF ARMY, PENTAGON
1 OCS-PERS DA ATTN CHF C&S DIV
1 DIR OF PERS STUDIES & RSCH DOCSPER DA WASH DC
2 ACSFOR DA ATTN CHF TNG DIV WASH DC
1 HQ ARMY MAT COMD R&D ORCTE ATTN AMCRD-RC
1 US ARMY BEHAVIOR & SYS RSCH LAB ATTNCRD-AR ARL VA
1 OPO PERS MGT DEV OFC ATTN MOS SEC (NEW EQUIP) OPOMO
1 PROVOST MARSHAL GEN DA
2 DIR CIVIL AFFAIRS ORCTE DOCSOPS
1 OFC RESERVE COMPON DA
12 ADMIN DOC ATTN: TCA (HEALY) CAMERON STA ALEX., VA. 22314
1 CHF OF R&D DA ATTN CHF TECH & INDSTR LIAISON OFC
1 CO USA CDC MED SERV AGCY FT SAM HOUSTON
1 USA BEHAVIOR & SYS RSCH LAB ATTN CRD-AIC ARL VA
2 TNG & DEVEL DIV DOCSPERS
1 CAREER MGT BR ATTN R DETIENNE CAMERON STA ALEX VA
1 USA LIB DIV-TAGO ATTN ASDIRS
15 CG CONARC ATTN ATIT-STM FT MONROE
2 CG CONARC ATTN LIB FT MONROE
1 CO ARMY CBT DEVEL COMD MILIT POLICE AGY FT GORDON
1 CHF USA AD HRU FT BLISS
1 CHF USA ARMOR HRU FT KNOX
1 CHF USA AVN HRU FT RUCKER
1 CHF USA INF HRU FT BENNING
1 CHF USA TNG CTR HRU PRES OF MONTEREY
1 1ST ARMORED DIV HQ & HQ CO FT HOOD ATTN AC OF S G2
3 CG ARMY ARMOR CTR FT KNOX ATTN G3 AIBAGT
3 CG 82ND ABN INF DIV ATTN ACOFS G3 FT BRAGG
1 CO 197TH INF BRGD FT BENNING ATTN S3
5 CG 1ST INF DIV ATTN ACOFS G3 FT RILEY
1 CO USA PARTIC GP USA TNG DEVICE CTR FLA
2 DA OFC OF ASST CHF OF STAFF FOR COMM-ELCT ATTN CETS-6 WASH
1 DIR ARMY LIB PENTAGON
1 CHF OF MILIT HIST DA ATTN GEN REF BR
1 CO USA 10TH SPEC FORCES GP FT DEVENS
1 US ARMY GEN EQUIP ATTN TECH LIB FT LEE
10 CG III CORPS & FT HOOD ATTN G3 SEC FT HOOD
30 CO 1ST ARMORED DIV ATTN G3 SEC FT HOOD
30 CG 20 ARMORED DIV ATTN G3 SEC FT HOOD
1 CG USAFAC & FT SILL ATTN AKPSIGT-INTN
20 CO III CORPS ARTY ATTN G3 SEC FT SILL
1 RSCH CONTRACTS & GRANTS BR ARO
1 BESO-ARO OFC CHF OF R&D WASH DC
1 CHF OF R&D DA ATTN SCI INFO BR RSCH SPT DIV WASH DC
1 CG USAFACFS ATTN AKPSIAG-AS FT SILL
1 CINC US ATLANTIC FLT CODE 312A USN BASE NORFOLK
1 COR TNG COMMAND US PACIFIC FLT SAN DIEGO
5 TECH LIB PERS LIB BR OF NAV PERS ARL ANNEX
3 OIR PERS RES DIV BUR OF NAV PERS
1 TECH LIB BUR OF SHIPS CODE 210L NAVY DEPT
3 CO & DIR NAV TNG DEVICE CTR ORLANDO ATTN TECH LIB
2 CO FLT TNG CTR NAV BASE NEWPORT
1 CO FLEET TNG CTR US NAV STA SAN DIEGO
1 PRES NAV WAR COLL NEWPORT ATTN MAHAN LIB
3 CO SERV SCH COMD NAV TNG CTR SAN DIEGO
1 CHF OF NAVL RSCH PERS & TNG BR (CODE 458) ARL VA
1 DIR US NAV RES LAB ATTN CODE 5120
1 DIR NAVAL RSCH LAB ATTN LIB CODE 2029 WASH DC
1 CHF OF NAV AIR TNG TNG RES DEPT NAV AIR STA PENSACOLA
3 OIC NAV PERS RES ACTVY SAN DIEGO
1 OIR PERS RES LAB NAV PERS PROGRAM SUPPORT ACTIVITY WASH NAV YD
5 COMDT MARINE CORPS HQ MARINE CORPS ATTN CODE AO-1B
1 DIR MARINE CORPS EDUC CTR MARINE CORPS SCH QUANTICO
1 US MARINE CORPS HQS HIST REF LIB ATTN MRS JADOT
2 COMDT HQS 4TH NAV DIST ATTN EDUC ADV NEW ORLEANS
1 CHF OF NAV AIR TECH TNG NAV AIR STA MEMPHIS
1 CHF OFCR PERS RES & REVIEW BR COAST GUARD HQ
1 CO US COAST GUARD TNG CTR GOVERNORS ISLAND NY
1 CO US COAST GUARD TNG CTR CAPE MAY NJ
1 CO US COAST GUARD TNG CTR & SUP CTR ALAMEDA CALIF
1 CO US COAST GUARD INST OKLA CITY OKLA
1 CO US COAST GUARD RES TNG CTR YORKTOWN VA
1 SUPT US COAST GUARD ACAD NEW LONDON CONN
1 AIR TNG COMD/XPT RANDOLPH AFB
1 TECH DIR TECH TNG DIV(HRO) AFHRL LOWRY AFB COLO
1 CHF SCI DIV ORCTE SCI & TECH DCS R&D HQ AIR FORCE AFRSTA
1 CHF OF PERS RES BR ORCTE OF CIVILIAN PERS OCS-PERS HQ AIR FORCE
1 CHF ANAL DIV (AFPDPL (R) DIR OF PERSONNEL PLANNING HQS USAF
1 ATC ATXRQ RANDOLPH AFB
2 MILIT TNG CTR OPE LACKLAND AFB
1 AMD AMRH BROOKS AFB TEXAS
1 HQS ATC DCS/TECH TNG (ATTMS) RANDOLPH AFB
1 USASA DIR OF THE LIB USAF ACAD COLO
1 TECH TNG CTR (LMTC/OP-I-LI) LOWRY AFB
3 CIA ATTN CRS/ADD STANDARD DIST
1 SYS EVAL DIV RES DIRECTORATE DOD-OCD PENTAGON
1 DEPT OF STATE BUR OF INTEL & RES EXTERNAL RES STAFF
3 US INFO AGY INT L PROCUREMENT LIB
1 SCI INFO EXCH WASHINGTON
2 CHF MGT & GEN TNG DIV TR 200 FAA WASH DC
1 EDUC MEDIA BR DE HEW ATTN T O CLEMENS

1 OFC OF INTERNATL ING PLANNING & EVAL BR AID WASH DC
2 ERIC DE WASH DC
1 CONSOL FED LAW ENFORCEMENT TNG CTR WASH DC
2 SYS DEVEL CORP SANTA MONICA ATTN LIB
2 DUNLAP + ASSOC INC DARIEN ATTN LIB
2 RAC ATTN LIB MCLEAN VA
1 RAND CORP WASHINGTON ATTN LIB
2 ELECT PERS RSCH GP U OF SOUTHERN CALIF
1 COLUMBIA U ELEC RES LABS ATTN TECH EDITOR
1 MITRE CORP BEDFORD MASS ATTN LIB
2 LEARNING R&D CTR U OF PITTS ATTN DIR
1 HUMAN SCI RES INC MCLEAN VA
2 TECH INFO CTR ENGNR DATA SERV N AMER AVN INC COLUMBUS O
1 RAYTHEON SERV CO ATTN LIBN BURLINGTON MASS
1 GEN DYNAMICS POMONA DIV ATTN LIB DIV CALIF
1 DIR CTR FOR RES ON LEARNING + TEACHING U OF MICH
3 CANADIAN JOINT STAFF OFC OF DEF RES MEMBER WASHINGTON
3 CANADIAN ARMY STAFF WASHINGTON ATTN GSO2 TNG
1 AMER INSTS FOR RSCH ATTN LIBN PA
3 MATRIX RSCH CO FALLS CHURCH VA
1 GE CO WASH D C
1 ROWLAND + CO HADDONFIELD NJ ATTN PRES
1 AMER PSYCHOL ASSOC WASHINGTON ATTN PSYCHOL ABSTR
1 ENGNR LIB FAIRCHILD HILLER REPUBLIC AVN DIV FARMINGDALE N Y
2 ASSOC DIR CDC TNG PROG ATLANTA GA
2 WASH MILITARY SYS TECH LIB DIV BETHESDA MD
2 CHRYSLER CORP DEF ENGR ATTN DR H BERMAN DETROIT
1 DR H SHOEMAKER DIR TNG RSCH GP NY
1 U OF MINN DEPT OF INDUST EDUC ATTN R E KUHL
1 CHF PROCESSING DIV DUKE U LIB
1 U OF CALIF GEN LIB DOCU DEPT
1 FLORIDA STATE U LIB GIFTS + EXCH
1 PSYCHOL LIB HARVARD UNIV CAMBRIDGE
1 U OF ILL LIB SER DEPT
2 U OF KANSAS LIB PERIODICAL DEPT
1 U OF NEBRASKA LIBS ACQ DEPT
1 OHIO STATE U LIBS GIFT + EXCH DIV
1 PENNA STATE U PATTEE LIB DOCU DESK
1 PURDUE U LIBS PERIODICALS CHECKING FILES
1 STANFORD U LIBS DOCU LIB
1 LIBN U OF TEXAS

1 SYRACUSE U LIB SER DIV
1 SERIALS REC UNIV OF MINN MINNEAPOLIS
1 STATE U OF IOWA LIBS SER ACQ
1 NO CAROLINA STATE COLL OH HILL LIB
2 BOSTON U LIBS ACQ DIV
1 U OF MICH LIBS SER DIV
1 BROWN U LIB
1 COLUMBIA U LIBS DOCU ACQ
1 DIR JOINT U LIBS NASHVILLE
1 U OF DENVER MARY REED LIB
2 LIB GEO WASH UNIV ATTN SPEC COLL DEPT WASH DC
2 LIB OF CONGRESS CHF OF EXCH + GIFT DIV
1 U OF PGH DOCU LIBN
1 CATHOLIC U LIB EDUC & PSYCHOL LIB WASH DC
1 U OF KY MARGARET I KING LIB
1 U OF LOUISVILLE LIB BELKNAP CAMPUS
1 GEORGETOWN U LIB SER DEPT WASH DC
1 LIBS COLO STATE U ATTN DOC LIBN FT COLLINS
1 DR G BEVER COLUMBIA U
1 DR J BORMUTH UNIV OF CHICAGO
1 DR R CALFEE STANFORD U
1 DR J B CARROLL ETS PRINCETON
1 DR A CHAPANIS JOHNS HOPKINS U
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