DOCUMENT RESUME

ED 102 532 CS 001 656

AUTHOR	Sticht, Thomas G., Ed.
TITLE	Reading for Working: A Functional Literacy Anthology.
INSTITUTION	Human Resources Research Organization, Alexandria, Va.
PUB DATE	75
NOTE	194p.
AVAILABLE FROM	HumRRO, 300 North Washington Street, Alexandria, Virginia 22314 ($5.95)
EDRS PRICE	MF-$0.76 HC Not Available from EDRS. PLUS POSTAGE
DESCRIPTORS	Adult Literacy; Armed Forces; *Literacy; *Literacy Education; Reading; Reading Improvement; *Reading Research; *Reading Skills; *Vocational Education

ABSTRACT

This anthology, prepared by adapting existing material, contains a synoptic review of the Human Resources Research Organization research program on literacy in relation to job performance. In several of the chapters, the adaptations include the addition of new material to integrate and interpret the findings from the various phases of the research program. Part one reports on research to develop general methodologies for estimating functional literacy demands of jobs. Each of four chapters describes an approach to this problem; a fifth chapter presents a general summary and critical discussion of the various methods used in this research to estimate the reading requirements of jobs. Part two is concerned with methods of reducing discrepancies between personnel literacy skills and the literacy demands of jobs. The first chapter describes basic research on reducing reading demands of training schools by substituting listening for reading, and comments on preparing job and training aids capable of being more effectively used by less literate personnel. The second chapter describes an extensive research and development effort to design, develop, and implement a job related literacy training program for the army. (WR)

Reading for Working:

A Functional Literacy Anthology

Thomas G. Sticht, Editor

A compilation of research on job-related literacy conducted
by the Human Resources Research Organization

HumRRO
HUMAN RESOURCES RESEARCH ORGANIZATION

1975

Foreword

This anthology comprises a synoptic review of the HumRRO research program on literacy *in relation to job performance*.

The volume has been prepared for two purposes. First, it provides a convenient, comprehensive response to inquiries about what research HumRRO has done on literacy in relation to work; such inquiries have become increasingly frequent as the distinction between functional literacy and literacy per se has become an integral part of the thinking of those concerned with issues such as career education, job training, and the validity of job requirements.

Second, this compilation makes the results of our research program readily available for application in education and training activities and in development of job materials. Our explorations of literacy as a job-functional process would be relevant, for example, in universities for use as supplemental course reading materials, and in the military services for consideration in developing training and job literature.

HumRRO work in functional literacy has been sponsored primarily by funding from the Army, the Department of Defense, and the Air Force. Some work—mainly didactic in nature—has been funded by the National Institute of Education through the Career Education Division of the Northwest Regional Educational Laboratory. Dr. Thomas G. Sticht, the editor of this anthology, has been the leader of this research program since its inception at HumRRO's Western Division.

This anthology has been prepared by adapting existing material (some previously published, some not). In several of the chapters, the adaptations include the addition of new material to integrate and interpret the findings from the various phases of the research program.

Meredith P. Crawford
President
Human Resources Research Organization

Preface

Little did I realize when Dr. Howard H. McFann, Director of HumRRO's Western Division in Monterey, called me into his office in the fall of 1967, that we would engage in a conversation that would extend over the next eight years!

It was during this meeting that Howard told me of the Department of Defense's concern for the literacy skills of the Project 100,000 men who were entering the service at that time. He shared with me a document prepared by DoD manpower specialists, calling for a thorough examination of the literacy requirements of Army jobs. HumRRO, which was then operating under contract to the Army, was being asked if we thought it feasible to conduct research to determine literacy requirements of Army jobs. Howard and I agreed that such research was feasible, and I was tasked with developing a research proposal.

The proposal, which was subsequently accepted, initiated HumRRO Work Unit REALISTIC. Over the next eight years this was followed by Work Units READNEED, LISTEN, and FLIT. Our research activities expanded to encompass the study not only of the literacy demands of Army jobs, but also of methods for reducing these demands and for improving the reading skills of personnel through literacy training.

All of this research and development has focused on the study of literacy in relation to work. As it turns out, civilian educators have been moving on a parallel course; their interest in work-related literacy skills has emerged as a major focus in the seventies. Extensive R&D efforts are under way to produce alternatives to the general education system that will promote career achievement and development—for example, the U.S. Office of Education's employer-, home-, and school-based programs, which are aimed at providing career-relevant education.

The USOE's Right to Read program has recognized the critical role of literacy in rendering a person employable. It is committed to eliminating illiteracy and functional illiteracy in this decade.

The Civil Rights Commission, the Equal Employment Opportunity Commission, and the Department of Labor have stimulated further interest in the problem of identifying literacy demands of jobs. They have done this by developing programs to ensure that various minority groups are not excluded from career opportunities by tests that (a) do not represent the demands of the job, or (b) underestimate the possibility of success on the job for minority groups.

Two factors emerging from these military and civilian programs have stimulated this compilation describing HumRRO's work on job-related

literacy: (a) People want job-relevant skills and knowledges; and (b) literacy skills are perhaps the most salient of the formally acquired skills demanded by varied occupations in our complex, technologically based nation.

If, as a nation, we are to develop for our children and out-of-school adults the literacy training programs that will enable them to find rewarding careers, we need a thorough understanding of the reading requirements of jobs, and we need methods for teaching job-relevant reading skills. We also need to know how to remove unnecessary obstacles to employment, such as poorly designed job manuals and other written materials, and inflated credential requirements.

The HumRRO literacy research program is about these kinds of problems. Its results and conclusions can aid a variety of audiences: policymakers who need information about the literacy skills of people and the literacy demands of jobs; reading researchers and other investigators who want to explore the nature of reading in its "functional" application; reading teachers who want knowledge of the targeted levels for job-related reading, as well as ideas for developing job-related reading programs.

I hasten to add, however, that the information presented in this volume does not cover the total universe of "functional literacy"; we have restricted ourselves rather narrowly to job-related reading. We are aware, of course, that many other reading tasks exist and are, rightly, the concern of us all. These include the so-called "coping skills" tasks, such as reading government pamphlets, labels on grocery packages, and medical information, as well as reading literature for self-enjoyment. However, such tasks are not discussed at length in this volume because HumRRO has not been directly involved in such research. (Chapter 9 refers to some research dealing with other than job-related literacy.)

As might be expected, research as extensive and of such long duration as ours has involved the efforts of many people. Dr. Ralph Canter,[1] formerly Director of Research, Manpower and Reserve Affairs, Department of Defense, deserves special mention. His office, support, influence, and counsel provided the springboard for Work Unit REALISTIC, from which our subsequent R&D evolved.

A central figure in the Army has been COL Ullrich Hermann, a member of the Army Research Institute and Chief of the Human Research Unit at the Presidio of Monterey for some five of the eight years we have been involved in literacy R&D for the Army. Rick has offered the utmost in support and encouragement; indeed, he has contributed substantively to the development and dissemination of the job-related reading program produced in Work Unit FLIT by participating in the many project

[1] Now Chief, Manpower Development and Utilization Technical Area, Army Research Institute.

management meetings, intervening when cross-currents became strong, and packing his traveling clothes and hitting the dissemination trail!

Within HumRRO's management structure, Dr. McFann, Director of the Western Division, has been the person most responsible for keeping the literacy programs moving. His thinking and planning on the various projects, and his interaction with people at all levels of Army management, have stimulated the interest to keep the literacy work going. There is no doubt that, without Howard's efforts, this book could not exist today.

Of the people who have worked on the various literacy projects, some have been associated with all of them; others have contributed to one or more of the projects. The following listing recognizes this distinction:

Primary Literacy Research Personnel

Dr. John S. Caylor, Senior Scientist, has had primary responsibility for collecting and analyzing data in the various literacy research projects, and has been involved in all phases of conceptualizing, planning, conducting, and reporting research.

Mr. Lynn C. Fox, Research Scientist, has served as a researcher on all literacy research projects and has been primarily responsible for operating the experimental FLIT reading program at Fort Ord for more than two years.

Dr. Richard P. Kern, Senior Scientist, has had primary responsibility for collecting and analyzing data leading to the development of job reading task tests, and has contributed to conceptualizing and designing materials for teaching job-related reading skills.

Mr. Robert N. Hauke, Research Scientist, has contributed to designing and developing the job-related reading program, and to conceptualizing the basic skills involved in reading.

Mrs. Nina McGiveran, Secretary, has been secretary and office manager on all of the literacy research projects, and has personally prepared the vast bulk of camera-ready, job-related reading materials used in the FLIT program.

Additional Literacy Research Personnel

The following past and present HumRRO and military research personnel have made significant contributions to one or more of the literacy research projects.

HumRRO Personnel	*Military Research Personnel*
Lawrence Beck	SP Marvin Castagna
Harry Burckhardt	SP Donald Enderby
Kent Huff	SP Richard Ferrington

HumRRO Personnel

Leslie Kahl
Richard McCrady
Wendy McGuire
David Triplett
Diana Welty Zapf

Military Research Personnel

SP Patrick Ford
SP Susan Foresman
SP Richard Havlik
SP Ronald Hooven
SP James Je·
SP Rip Mcl ·rs
SP Albert Santos
SP Steven Snyder
SP William Verostko
SP Richard Wuerthner
SP Timothy Work
SP Bruce Mercier

Administrative and Editorial Support

Mr. Donald Polden, Deputy to the Director of HumRRO's Western Division, has provided the continuing administrative support needed to cope with supplies, budgets, and personnel requirements. In addition, he has from time to time participated in the actual conduct of the R&D, making significant contributions beyond the administrative area.

Finally, at the HumRRO central offices in Alexandria, Virginia, Dr. Eugene A. Cogan and Mrs. Lola M. Zook and the Editorial and Production Center under her management have skillfully transformed a steady procession of draft reports into a series of high quality products of which this book is one example.

To all these people I extend a hand in gratitude. It has been my privilege to work with them as Leader of these various literacy projects. I have found the fruits of our collective labors intellectually exciting, and socially relevant. I hope the readers of this book do, too.

T.G.S.

Monterey, California
December 1974

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Reading for Working:

A Functional Literacy Anthology

Chapter 1

Introduction

> Imagine, if you can, what your life would be like if you could not read, or if your reading skill were so meager as to limit you to the simplest of writings, and if for you the door to the whole world of knowledge and inspiration available through the printed word had never opened.
>
> For more than a quarter of our population this is true. For them education, in a very important way, has been a failure, and they stand as a reproach to all of us who hold in our hands the shaping of the opportunity for education.
>
> These individuals have been denied a right—a right as fundamental as the right to life, liberty and the pursuit of happiness—the right to read.[1]

With these words, the late James E. Allen, U.S. Commissioner of Education, launched a campaign against the blight of illiteracy which, paradoxically, thrives within the most highly educated and technologically advanced civilization ever to exist. One man writes of his walk along the craters of the moon—another of his countrymen is unable to read about it!

The problem of illiteracy was underscored in a recent study that asked: "How many Americans were prevented by reading deficiencies . . . from filling out application forms for such common needs as a Social Security number, a personal bank loan, Public Assistance, Medicaid, a driver's license?"[2] Among the outcomes of this study was the estimate that some 13% (18.5 million) of American adults had an error rate of at least 10% in filling out the forms, while 3% (4.3 million) had an error rate of more than 30%.

[1] Address by the late James E. Allen, Jr., former Assistant Secretary for Education and U.S. Commissioner of Education, before the 1969 Annual Convention of the National Association of State Boards of Education (1).

[2] Survival Literacy Study, Louis Harris and Associates, reported in the Congressional Record, November 18, 1970 (2).

RELATIONSHIP OF THE HumRRO RESEARCH TO THE GENERAL PROBLEM OF "FUNCTIONAL" LITERACY

Over the last 30 years there has been considerable rhetoric concerning "functional" literacy and what "functional" literacy levels ought to be (cf., Harman, 3; Voyat, 4; Corder, 5). Nevertheless, in 1968, when the research described in this book was initiated, no substantial research was found that had attempted to determine how literate a person must be to function adequately in some defined adult situation. This lack of information was acknowledged in 1970 by the initiation of a major research effort by the U.S. Office of Education, in conjunction with the "Right to Read" mandate. This effort called for the delineation of reading tasks deemed an integral part of American life and the designation of an effective level of performance on these tasks (Gephart and Penney, 6).

This same concern was expressed in 1974 by the Study Group on Linguistic Communication sponsored by the National Institute of Education (7). The Study Group recommended that:

> . . . two types of data be gathered for a random sample of occupations in the society:
>
> a. Data on the level of reading skills required to have access to the occupations.
> b. Data on the level of reading skills necessary to gain the knowledge to be able to perform adequately in the occupations.

As far as we know, the research on the reading requirements of Army jobs presented in this book presents the most extensive empirical work of the type proposed by the USOE and the NIE Study Group of Linguistic Communication. This research has studied *functional* literacy in terms of job-related literacy demands. In this work, we have defined *functional* literacy as possession of those literacy skills needed to successfully perform some reading task *imposed by an external agent* between the reader and a goal the reader wishes to obtain. To get a job as a mechanic → to earn money → to eat → to survive, requires reading skill to successfully (as defined by the employer) perform the reading tasks found in the mechanic's job. The terminal objective or goal is to eat and survive, but reading is an enabling skill demanded by the reading tasks of the job. Reading skills sufficient for performing such reading tasks are considered as *functional* literacy skills in this text.

On the other hand, if an individual imposes a reading task on himself, such as to read for enjoyment, for our purposes we do not consider this a *functional* reading task. That is, it is not externally imposed as an enabling task for a subsequent terminal goal, and hence it does not, for us, define a case of the use of *functional* literacy skills.

By this approach, whether literacy is or is not construed as *functional* depends upon the nature of the reading *task*—whether it is self- or externally imposed—and *not* upon a person's skill level.

Our study of job-related functional reading tasks rather than representative reading tasks performed by adults serves at least two functions. For one thing, it suggests skill levels as targets for adult basic education geared toward employment. For another, an examination of the literacy demands of jobs can indicate whether or not the presently stated literacy requirements of jobs are unnecessarily high.

In this latter regard, it should be noted that only some 13% of the jobs within the Army are strictly military. The remaining 87% are represented in civilian occupations (Wool and Flyer, 8). Also, today, under the All Volunteer Force concept, a military career is annually *chosen* by thousands of men and women as a means of obtaining education and training not otherwise available to them. Thus, military employment is for many simply one of the occupational alternatives to working in a steel mill, a coal mine, an automobile factory, or even as a college professor. For these reasons, the research to be reported should be of interest to career counselors in suggesting literacy skill levels their clients need, in order that they may be prepared to become gainfully employed.

LITERACY PROBLEMS AND THE MILITARY

In 1965, the United States launched its "War on Poverty." This program focused on the world of work and urged that the nation's businessmen, industries, and governmental agencies join in the War on Poverty by (a) examining their employment demands for education, literacy, and other requirements, to ensure that they were genuine *requirements*, not restrictive demands for credentials; and (b) up-grading the basic education (literacy) of employees and candidate employees to render them capable of performing other than dead-end jobs.

It was the Vietnam conflict, occurring as it did in the mid-sixties, and thus coinciding with the War on Poverty, that again focused the attention of military manpower experts on the problems of the lower mental aptitude, marginally literate man and his utilization in the Services. Four strategies had been followed at various times to cope wih the problems of illiteracy (or marginal literacy) in the Army and other Services. These strategies are described in the following paragraphs.

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 rather than 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.

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 (9). 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. 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. More recently, remedial training programs have been 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 jobs that have "minimal" requirements for reading. This strategy has not worked well 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 a job having relatively low requirements for literacy and arithmetic skills concerns the overall effectiveness of that entire job field. This may be reduced if the job becomes flooded with marginals. Therefore, some means are necessary for distributing these men equitably among the jobs within the Army.

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.

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 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 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.

PROJECT 100,000 AND THE HumRRO LITERACY RESEARCH

During the 1960s, the Department of Defense needed an enlarged manpower pool to meet the press of the Vietnam conflict; at the same time, there was increasing pressure from minority and "disadvantaged" groups for governmental actions to improve the employability of large segments of the working age population. Accordingly, the Department of Defense abandoned the strategy of nonacceptance of lower aptitude men that had existed following the Korean conflict and, in 1966, initiated Project 100,000. In this project, the Armed Services joined with other Federal agencies in the War against Poverty by re-examining entrance requirements to admit men who had previously been disqualified for military service because of low mental aptitude, or, less often, health defects.

As had been expected, the downward revision of mental aptitude standards created a substantial influx of marginally literate men into the Services, particularly the Army. Once again the Services were forced to consider the strategies of remedial training, limited assignments, and modification of training and job requirements to accommodate the Project 100,000 personnel.

As indicated earlier, for knowledgeable implementation of any one of these courses of action, information is needed about the literacy skill demands of various jobs. In recognition of this need, the Office of the Assistant Secretary of Defense, Manpower and Reserve Affairs, and the Department of the Army (Deputy Chief of Staff for Personnel; U.S. Continental Army Command) entered into dialogue with the Human Resources Research Organization concerning the need for research on literacy and related training needs in the Armed Services. The result has been a series of research projects by HumRRO, starting in 1968, to (a) study and develop methodologies for determining functional literacy levels of military jobs within the Army; (b) explore techniques for reducing reading demands of jobs; and (c) develop a prototype literacy training program designed to provide a level of functional literacy appropriate to present *minimal* job reading requirements.

REDUCING GAPS BETWEEN READING SKILLS OF PERSONNEL AND READING DEMANDS OF JOBS

Knowledge about reading demands of jobs can be used to better match readers and jobs through the three strategies mentioned earlier: assigning marginal readers to jobs with the least demands for reading; improving reading abilities of personnel to bring their skill levels up to the job reading requirements; and redesigning jobs and job training programs to reduce the level of reading skills needed to successfully perform the job.

Given knowledge of reading demands of jobs and valid measures of personnel reading skills, the strategy of limited assignments is primarily a

test and classification activity readily accomplished following routine administrative procedures.

Considerably more effort and expense are involved in implementing the strategies of reading training and redesign of jobs to cope with problems in employing marginally literate personnel. Part II of this text summarizes research pursuing both of these approaches to literacy problems. On the one hand, we have explored methods of reducing reading demands of jobs by substituting listening for reading requirements, and by simplifying job reading materials; on the other hand, we have explored the feasibility of improving personnel literacy skills in a brief period of time. Due to time constraints, this work has been focused on developing and evaluating job-related reading training to produce an immediate impact upon a person's ability to use job reading materials.

Over the years of this research, we have developed a practice of following a two-pronged approach to literacy problems encountered in organizational settings (government agencies, prisons, community colleges):

(1) Improve the people through literacy training aimed at the immediate reading tasks standing between them and their goals (sometimes set by the organization as a condition of employment).

(2) Reduce excessive demands for reading skills by designing better reading materials and other job and training aids.

While this text presents information related to both of these approaches, the emphasis is on literacy training. A forthcoming volume will deal with the design of job and training literature.

THE PLAN OF THIS BOOK

Our research on literacy has produced considerable information about literacy demands of jobs, job proficiency of men of various literacy skill levels, methodologies for estimating literacy demands of jobs, and efforts to modify men and jobs to better match men to jobs. While this research has been reported for public use, the information is presented in technical reports, journal articles, and HumRRO publications of limited distribution. Because many of these varied documents are widely dispersed and hard to obtain, it was deemed desirable to make a summation of this research available in this single volume.

Part I reports research to develop general methodologies for estimating functional literacy demands of jobs. Each of four chapters describes an approach to this problem; a fifth chapter presents a general summary and critical discussion of the various methods of estimating reading requirements of jobs used in this research and by others.

Part II is concerned with methods of reducing discrepancies between personnel literacy skills and the literacy demands of jobs. The first chapter describes basic research on reducing reading demands of training schools

by substituting listening for reading, and comments on preparing job and training aids capable of being more effectively used by less literate personnel. The second chapter describes an extensive R&D effort to design, develop, and implement a job-related literacy training program for the Army—an effort still under way at this writing. While changes undoubtedly will be made to the program as reported, the chapter is offered as an example of one approach to teaching reading "in the content areas" on a large scale.

Parts I and II report programmatic work on literacy under Army sponsorship; Part II deals more generally with problems of adult literacy within and outside the Department of Defense. While the three chapters are not articulated, a common thread is a concern for reading for employability and career progression. In this sense they are consistent with the functional literacy work reported in Parts I and II.

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Part I

Determining Functional Literacy Demands of Jobs

Introduction

The ability to perform adequately on many military jobs is determined to some extent by the individual's ability to read. The content and teaching level of many military training courses and the reading level of many job manuals and other technical materials presuppose literacy levels as high as a college sophomore or higher. Men who are below that level, therefore, can be expected to experience difficulty in using instructional material and manuals in training for or performing their military jobs.

The initiation of Project 100,000 by the Department of Defense in 1966 brought many men of marginal literacy skills into the Armed Services. This influx of men with lower-level language and reading skills strains a training system geared to verbal, lecture-platform types of instruction. Classification of these men into jobs for which their reading skills are sufficient is also a problem, since little information is available concerning the literacy skill levels suitable for a given job. Furthermore, the designation of targeted levels of remedial literacy programs is performed blindly, since it is not known what level of reading-language skills is needed for adequate job performance.

Because of the low literacy skills of many of the Project 100,000 men, there was concern among manpower specialists that many of these "new standards" men might be assigned to jobs wherein the demands for literacy skills might far exceed the ability of the men, and possibly lead to job failure. Furthermore, it was anticipated, and subsequently confirmed (see Chapter 8 of Part II), that as the Army turned to an all-volunteer force, a significant proportion of manpower would have to be drawn from the

pool of less academically trained, marginally literate workers.

METHODOLOGIES FOR DETERMINING LITERACY DEMANDS OF JOBS

Facing these problems directly, the Army sponsored research by HumRRO to develop methodologies for determining the literacy requirements of Army jobs. In pursuit of such information, four approaches for assessing reading demands were studied:

(1) The reading grade level of difficulty of job printed materials was determined using a readability formula especially designed and calibrated for use with Army personnel and Army job materials (Chapter 2).

(2) Special job reading task tests (JRTT) were developed and the correlation of general reading with job reading task performance was obtained. With these data, estimates of general reading skill levels needed to meet various criterion levels of performance on the JRTT were derived (Chapter 3).

(3) Relationships were examined between the reading, listening, and arithmetic skills of job incumbents in four jobs, and the performance of these men on three different indices of job proficiency: Job Knowledge tests, Job Sample performance tests, and Supervisor's ratings. The Job Sample tests were 4 to 5 hour tests in which Cooks cooked, Repairmen repaired vehicles, and so forth. In other words, these were extensive "hands-on" samples of what personnel in the jobs studied actually do. Correlations among the literacy tests and the job proficiency measures were used to state minimal requirements for literacy skills in these jobs (Chapter 4).

(4) The use of existing personnel records in the determination of reading skill level requirements of jobs was illustrated by the development of a formula for estimating reading grade levels of ability from the Armed Forces Qualification Test (AFQT). Determination was then made of the correlation between estimated reading ability and job proficiency indexed by the Army's primary test of job proficiency, the Enlisted Evaluation Test. Minimal reading levels associated with minimally accepted performance

on the EET were then established for several jobs to illustrate the use of this approach (Chapter 5).

OVERVIEW OF MAJOR FINDINGS

The research on readability provided the following results:

(1) A simple, easy-to-administer formula was produced 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 (FORd, CAylor, STicht) formula, following the usual practice in readability research.

(2) 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 job reading materials.

(3) Data indicated that more than half the reading materials in each of seven jobs exceeded the grade 11.0 level of difficulty as estimated by use of the FORCAST formula.

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) The use of a decision rule stating that 80% of the personnel reading at a given reading level should get 70% correct on the JRTT for their job suggests that the minimum literacy requirement for Cooks would be grade 7.0, and for Repairmen grade 8.0, while 10th grade ability would be needed for Supply Clerks.

Research on relationships of reading ability to job proficiency indexed by Job Knowledge (paper-and-pencil) tests, Job Sample tests, and Supervisor's ratings indicated that:

(1) Reading ability was related to Job Knowledge and Job Sample measures of job proficiency, but not to Supervisor's ratings.

(2) Application of a decision rule that sets the reading requirement of a job at the level of reading associated with being in the top three quarters of job performers suggested a reading level for Cooks of grade 7.0 level; for Repairmen and Armor Crewmen, grade 8.0 level; and for Supply Clerks, grade 9.0 level.

Finally, the research on the feasibility of using information in present Army data files to estimate the reading demands of jobs 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) Reading grade level scores associated with management established proficiency cut-off scores for the job evaluation test for seven jobs indicated that minimal passing scores in two jobs were too low to estimate reading requirements using this method; for five jobs, the reading requirements so estimated ranged from grade levels 7 through 9.

To complete the discussion of methodologies for assessing literacy demands of jobs, the final chapter of Part I (Chapter 6) summarizes the methods used by HumRRO in the Army research, as well as some techniques used by Department of Labor and Department of Defense job analysts, and offers a critical discussion of the relative merits of the various approaches.

Chapter 2

Readability of Job Materials

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 (1). 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 (1, 2, 3). In Army research, a modification of a

Based on Chapter 2 of HumRRO Technical Report 73-5, *Methodologies for Determining Reading Requirements of Military Occupational Specialties*, by John S. Caylor, Thomas G. Sticht, Lynn C. Fox, and J. Patrick Ford, March 1973.

formula devised by Flesch in 1948 (4, 2) 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 (1, 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" (5, p. 225). In the Army research, the raw-score indices obtained with the Flesch formula were converted directly into school grade equivalents by means of a specially prepared table (3).[1]

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 a particular job 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 JOB MATERIALS

Several problems arise in applying existing readability formulas to 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 adult reading population and for job reading material,

[1] The Dale-Chall Readability formula was applied to a subset of these materials, and the results are described in 2.

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 possible 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 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.

THE FORCAST READABILITY FORMULA

Although available readability formulas have serious limitations for application to 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, HumRRO undertook development of a readability index that would be (a) based on essential 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 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 Jobs and Essential Job Reading Materials

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

Light Weapons Infantryman
Ground Control Radar Repairman
Wheel Vehicle Mechanic
Personnel Specialist
Armorer/Unit Supply Specialist
Medical Specialist
Military Policeman

These 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 this work, the definition of reading material essential to job performance was less so because the Army prescribes the source reading material on which the mandatory annual personnel job performance proficiency test is based. For each job, 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 these prescribed regulations and manuals were obtained for the seven jobs 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 jobs as evenly as possible.

Using the modified Flesch formula (6), 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.

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:

(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 (3). 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 calculated.

(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 was assessed to determine its value for each of the 15 structural properties listed.

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 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 150-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.

Relationships of Reading Grade Level to Comprehension of 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 (1, 5) 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 any adult sample, 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 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. The two sets of cloze passages were judgmentally 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

Reading Grade Level Distributions

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

Table 1

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

Reading Grade	Percent
2	0.8
3	2.0
4	4.3
5	6.6
6	6.6
7	7.1
8	14.2
9	10.3
10	7.8
11	25.0
12	15.1
Total	100

Intercorrelations Among Reading Measures

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 tested 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. 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.

Table 2

Intercorrelations Among Reading Measures

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

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

Table 3

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

Property	Passage											
	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

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 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 (5, 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 Reading test, achieved at least 35% correct on the cloze test for passage 21. A similar interpretation holds for the remaining passages.

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 Table 4.

For many passages, the variability of the mean cloze score from variation to variation is substantial, as shown in Table 4. Since only about

Table 4

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

Table 5

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 6.

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 these differences in cloze scores among the variations shown in the table.

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 6 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 6).

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 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

Intercorrelations of Passage Structural Property Variables and Mean Cloze Score

Variable	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	-.16	-.13	-.11	-.02	.11
9 Number of three-or-more syllable words									.98	.98	.58	.54	.94	.96	-.77
10 Total number of syllables										.99	.65	.62	.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															

multiple-linear-regression technique. As shown in Table 5, 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,[1] 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 estimated 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 (technical job reading matter) and a defined population of readers (young male soldiers). Unlike most general-purpose readability

[1] This simplification is obtained at some slight cost in precision. For more precise determination the unsimplified formula should be used.

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 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 7 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.

Table 7

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

Similarly, they are all highly, and about equally, related to the scaled RGL required to comprehend the passages.

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 job reading material independent of that on which it was empirically derived. The initial design was replicated, using another sample of 12 job reading passages from the same jobs 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 8, the FORCAST values for the 12 passages correlated .77 with their scaled reading grade level scores; these again defined as the lowest reading 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 8

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 *rs* 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 to Estimate Reading Demands of Jobs

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

Table 9 presents, for each job, 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 jobs can be ranked on how well the reading difficulty of materials in the job matches the average reading ability of personnel (i.e., 9 to 9.9). Applying this procedure, we find that the Medical Specialist 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 jobs have the following

Table 9

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

RGL[a]	Job[b]						
	A (N = 104)	B (N = 95)	C (N = 108)	D (N = 95)	E (N = 83)	F (N = 90)	G (N = 139)
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	0.0	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]A, Light Weapons Infantrymen; B, Ground Control Radar Repairmen; C, Wheel Vehicle Repairmen; D, Personnel Specialist; E, Armorer/Unit Supply Specialist; F, Medical Specialist; G, Military Policeman.

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%.

Although there are clear differences in readability of job printed materials among the jobs, *all* the jobs show readability levels well above the ninth-grade level. These findings confirm previous observations (2, 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. The findings also suggest that many personnel will need special literacy training to efficiently and effectively use much of their job reading materials. These readability data are discussed further in Chapter 3.

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Chapter 3

Performing Job Reading Tasks

The readability method for establishing literacy requirements of jobs described in Chapter 2 is relatively simple and inexpensive, but it does not involve the direct assessment of the ability to read and understand job reading materials.

In this chapter, a second 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 jobs: Vehicle Repairman, Unit and Organization Supply Clerk, and Cook. 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 training in that job area.

Finally, this research has produced data showing relationships among the Armed Forces Qualifying Test (AFQT), Standardized Reading Test (SRT) performance, JRTT, and end-of-course, academic, job training scores.

Based on Chapter 4 of HumRRO Technical Report 73-5, *Methodologies for Determining Reading Requirements of Military Occupational Specialties*, by John S. Caylor, Thomas G. Sticht, Lynn C. Fox, and J. Patrick Ford, March 1973, and Chapter 2 of HumRRO Technical Report 71-23, *Determination of Literacy Skill Requirements in Four Military Occupational Specialties*, by Thomas G. Sticht, John S. Caylor, Richard P. Kern, and Lynn C. Fox, November 1971.

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 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, 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* 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 provides 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

Job-related reading materials were identified by means of a structured interview administered to men in the target jobs at their job locations. In

addition to personal data, such as name and unit, information was obtained regarding the use of listening and reading sources in obtaining job-relevant information, and the nature and frequency of use of arithmetic skills.

To identify use of listening sources the man was asked to give five instances when he had asked somebody for job-related information in the last month or so. Probing was continued until he could not think of any more instances.

A similar procedure was employed to identify use of printed materials or reading sources. The man was asked to give five examples of times, during the past month or so, when he had used printed materials in connection with performing a job. In each case he was asked to describe the job he had been performing and to tell what information he had been seeking when he went to the printed material. He was asked to get the manual, locate the exact page he had used, and then show the interviewer the specific parts of the material he had used in obtaining the desired information. This process was repeated until either five instances had been described or the individual could give no more; in any event, he was not pressed for examples beyond five in number.

A similar procedure was used to elicit comments about the use of arithmetic. An attempt was made to get at least five citations of the use of arithmetic. The type of task performed using arithmetic was noted, and the type of arithmetic (i.e., addition, subtraction, etc.) was determined from the nature of the tasks reported.

Subjects

Job incumbents were selected on the basis of reading grade level scores, with the additional requirement that their total time in the job fall between one and 18 months. Because of entry training and leave time, 18 months tends to be the uppermost limit for individuals serving the standard draftee's two-year tour of duty. Thus the data refer to men serving in their jobs for a period of time no greater than a single tour of duty.

In order to select potential interviewees on reading grade level scores, it was necessary to first schedule special testing sessions and administer the reading achievement test. Since it was not feasible to administer reading tests to all men who were serving in the target job positions at a given installation, it was necessary to prescreen from available personnel records with the hope that the desired number who qualified within each of the three reading levels would be obtained. This prescreening was accomplished by selecting for reading testing only those who had between one and 18 months of job experience and by selecting equal numbers of men whose Armed Forces Qualification Test (AFQT) scores fell between 0-20, 30-50, and 51-100. While the exact AFQT category limits used were somewhat arbitrary, the general rationale for defining groups was based on results of previous studies.

In these studies correlations between AFQT and the reading achievement test averaged approximately .65 (see Chapter 4 for information about the AFQT).

Table 10 shows the number of men interviewed at each reading level interval for each of the three job positions. This table also shows the means, and standard error of the means, for the AFQT scores and the reading grade level scores of each reading level subgroup.

Table 10

Descriptive Data on Men Interviewed in Each of the Three Job Positions

Job	N	AFQT		Reading Grade Score[a]	
		Mean	Standard Error	Mean	Standard Error
Supply Specialist					
High Reading Level (9.0+)	11	73.8	5.0	11.2	0.4
Middle Reading Level (7–8.9)	9	36.0	3.2	7.7	0.1
Low Reading Level (4–6.9)	10	17.4	3.0	6.3	0.2
	30				
Repairman					
High Reading Level (9.0+)	25	45.2	4.4	10.1	0.2
Middle Reading Level (7–8.9)	34	33.3	2.7	7.9	0.1
Low Reading Level (4–6.9)	26	24.7	2.5	6.1	0.1
	85				
Cook					
High Reading Level (9.0+)	15	63.6	3.8	11.2	0.4
Middle Reading Level (7–8.9)	16	35.1	3.6	8.0	0.2
Low Reading Level (4–6.9)	17	24.7	4.1	5.4	0.4
	48				

[a]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 jobs 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.

In using this classification scheme to construct reading task tests, the printed materials cited by the men in each job 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

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.

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

Table 12

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

Job	Subtest	Content Type[a]	Reading Difficulty Level[b]	
			Job Material	Test Question
Repairman	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	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	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.

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 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 (1) for both the job material and the test material.[1] In all measurable cases, the difficulty level of the materials exceeded that of the test questions.

The general nature of the reading task tests is shown in Figure 1, 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.

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 job 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 Career Skills 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 job 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

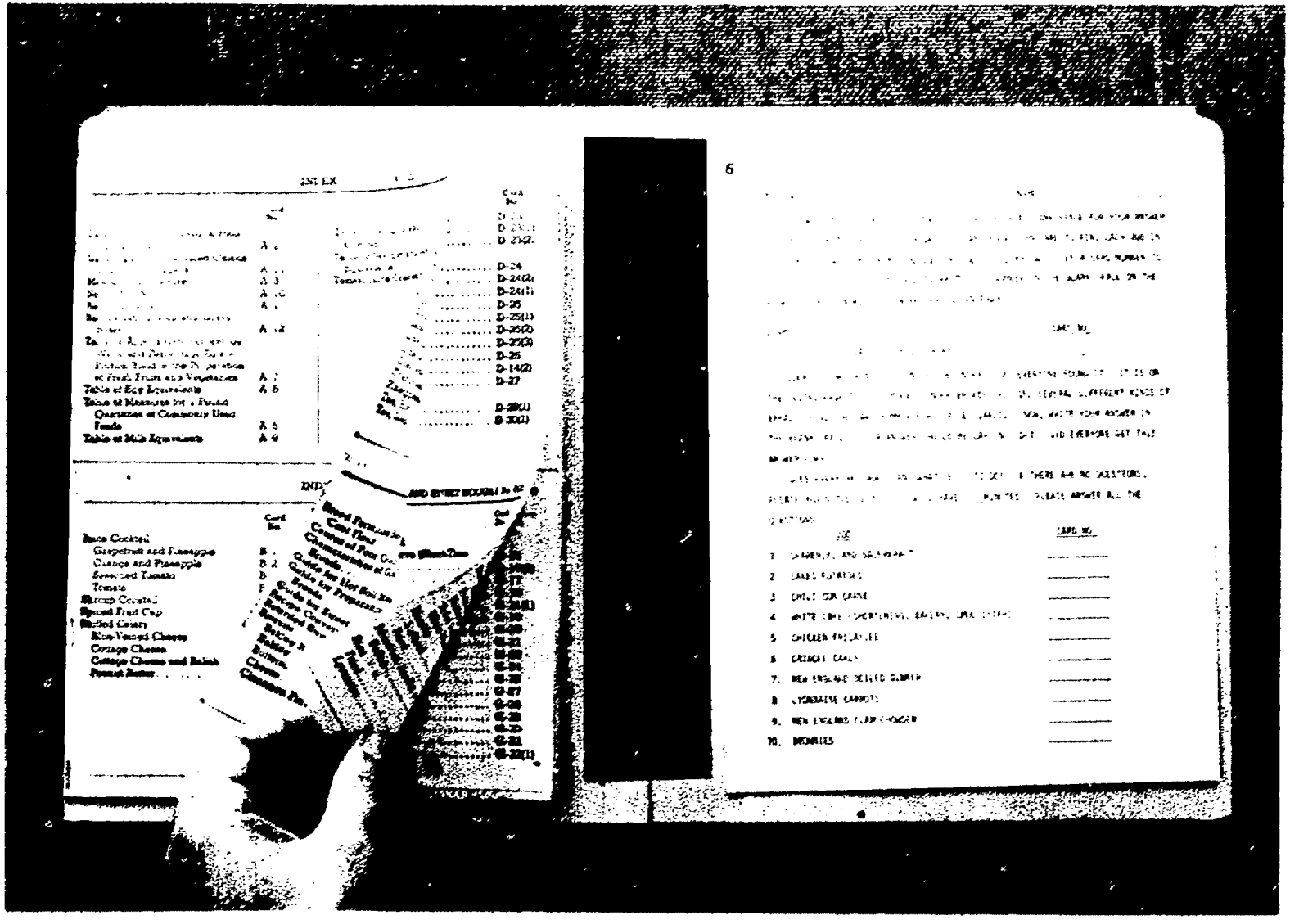
For each job, Table 13 presents data for AFQT, Standardized Reading Test (SRT) performance in reading grade level (RGL) scores, and scores for each subtest and a total score on the Job Reading Task Tests (JRTT).

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

[1] This research was accomplished prior to the development of the FORCAST readability formula described in Chapter 2.

Figure 1

Sample From the Cook's Job Reading Task Test



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

Measure	Maximum Possible Score	Mean			Standard Deviation			Number Tested		
		RS	Pre-CST[a]	Post-CST	RS	Pre-CST	Post-CST	RS	Pre-CST	Post-CST
	1	2	3	4	5	6	7	8	9	10
Cook										
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	3.66	3.92	3.80	195	322	298
Total	52	38.10	34.66	42.04	10.67	12.98	9.62	195	322	298
Supply										
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

[a]CST = Career Skill Training.

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 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 (see Chapter 4) 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 job training because of special aptitude for that work, and the Post-CST group was selected for special job aptitude *and* had completed 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 2, 3, and 4, which present mean percent correct scores for men of differing reading grade levels in the RS, Pre-CST, and Post-CST groups. The major finding shown is that, while in general completing CST appears to product 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.

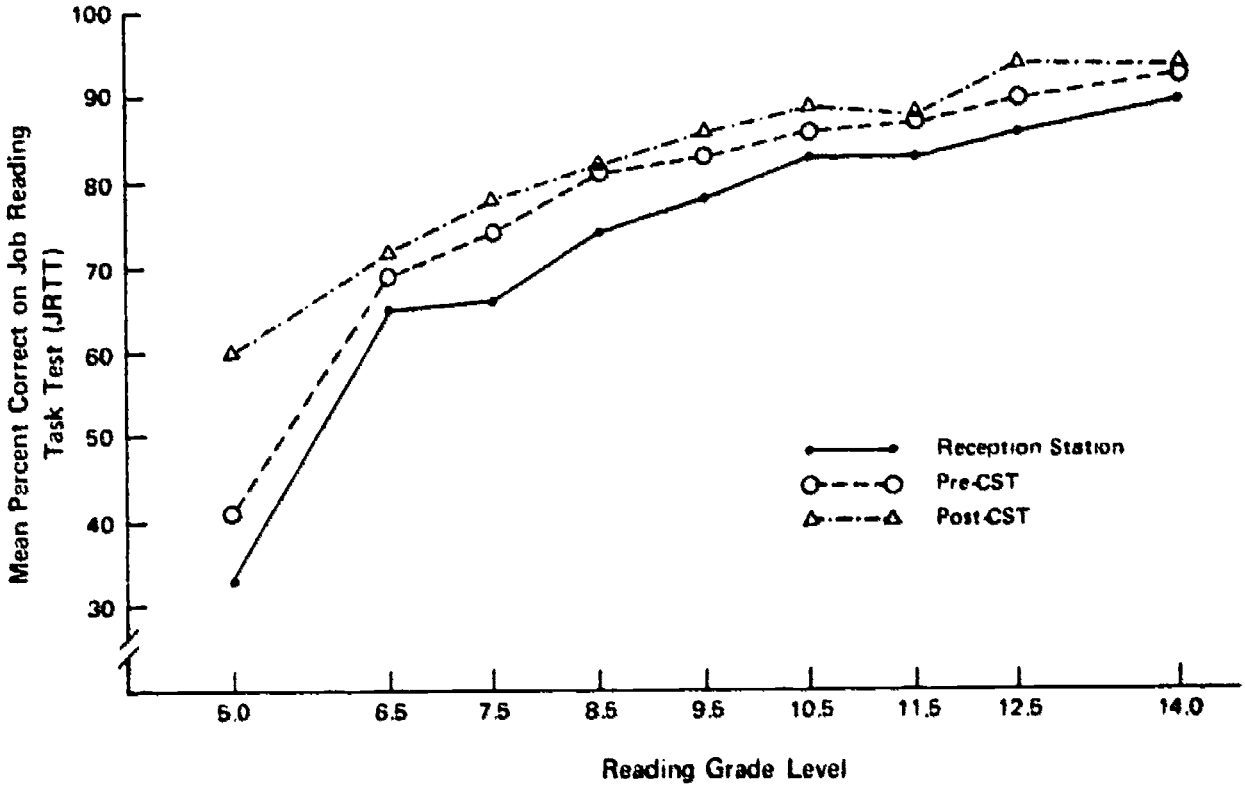
A second major finding presented in these figures is that general reading ability is highly related to JRTT performance for all three groups. This is further indicated in the data reported in this chapter.

Correlation Data

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

Figure 2

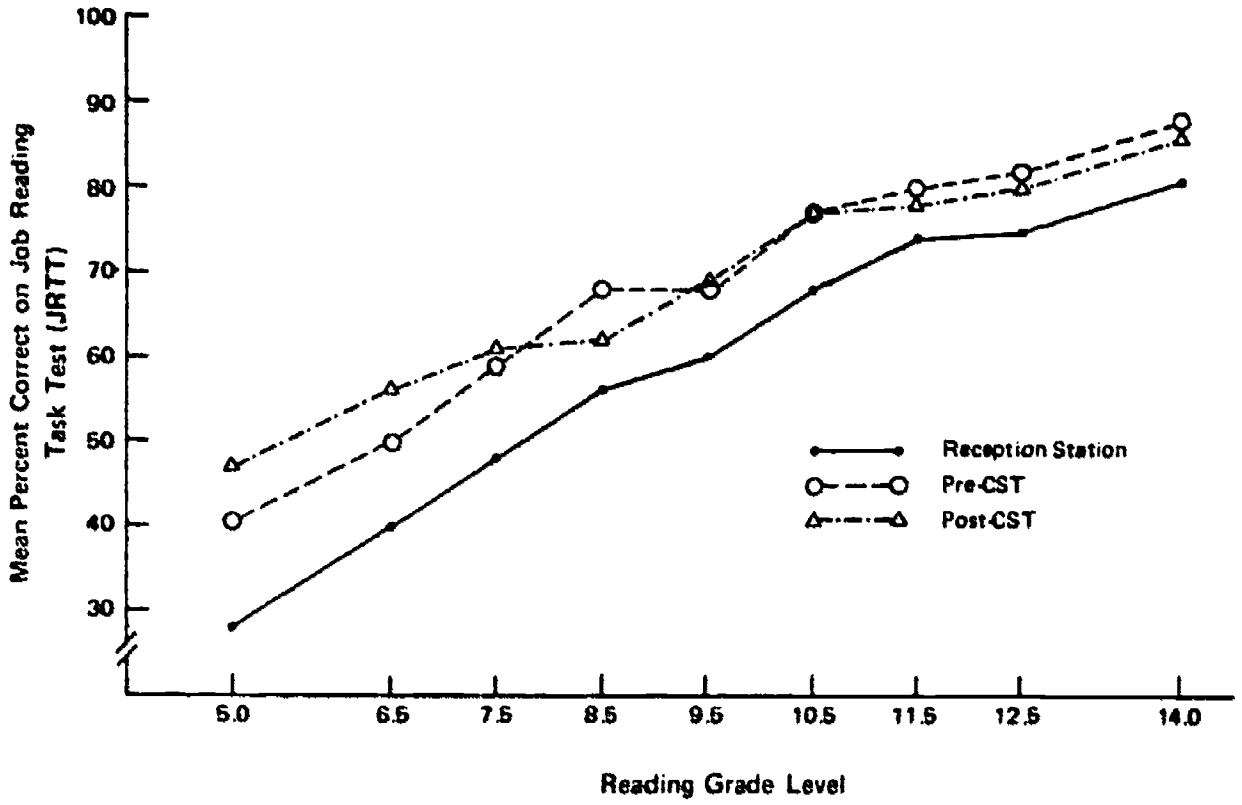
Repairman's Job Reading Task Test Scores for Men Tested at Reception Station and Pre- and Post-CST



Examining the three tables, it is seen that SRT(RGL) is about equally correlated with AFQT and JRTT, with *rs* 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 *rs* 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.

Figure 3

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



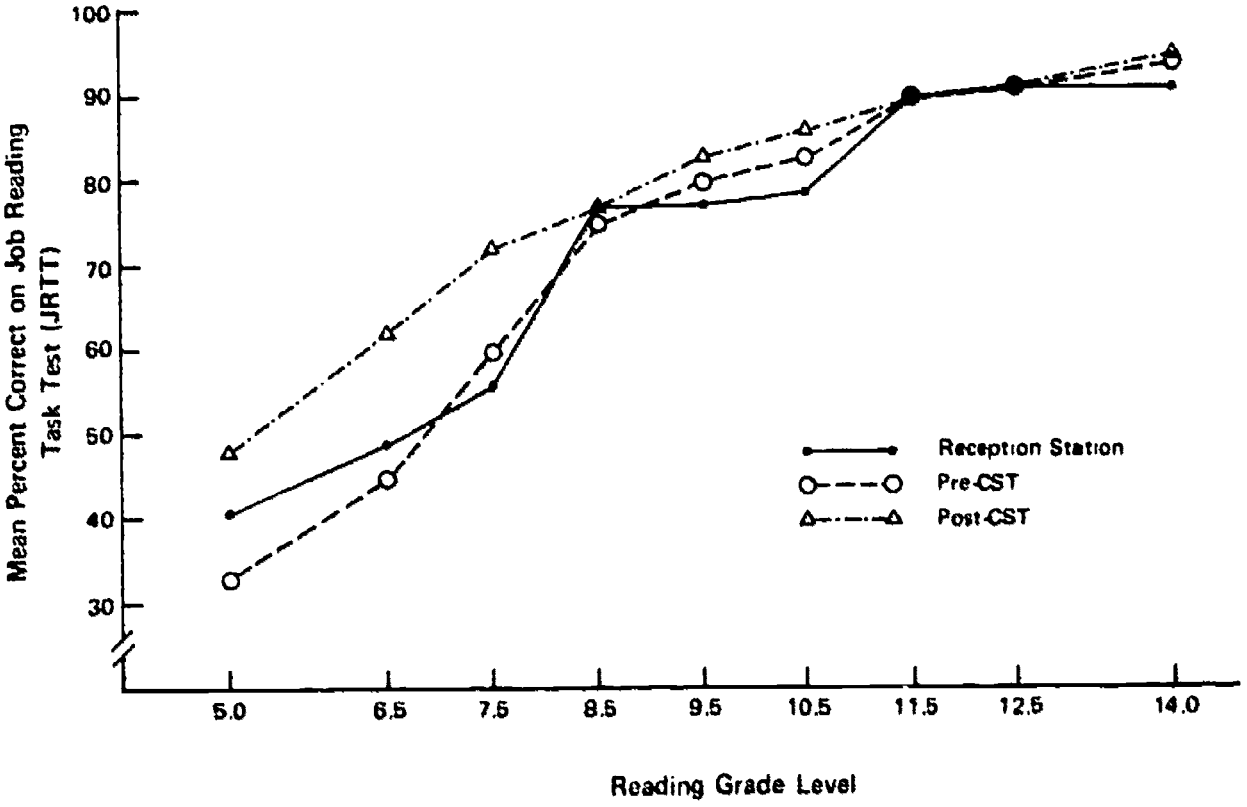
Intercorrelations Among JRTT Subtests and Remaining Variables

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 reflect 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

Figure 4

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



JRTT. The *r*s 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 *r*s. 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.

Reliability of JRTT

The testing schedule for the Pre-CST and Post-CST groups was such that a small sample of men in each school were included in both groups. For

Table 14

Intercorrelation Table for Vehicle Repairman

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	Rec. Sta.			199	.79	199	.66	199	.57	199	.44	199	.38	199	.52	199	.42	199	.56	199	.53				
AFQT	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	Rec. Sta.					201	.76	201	.62	201	.58	201	.46	201	.45	201	.52	201	.74	201	.62				
SRT	Pre-CST					219	.71	219	.55	219	.49	219	.32	219	.41	219	.32	219	.62	219	.53	205	.59		
(RGL)	Post-CST					248	.65	248	.54	248	.41	248	.25	248	.42	248	.40	248	.57	248	.51	247	.67		
3	Rec. Sta.							201	.77	201	.80	201	.63	201	.73	201	.75	201	.85	201	.73				
JRTT	Pre-CST							219	.71	219	.67	219	.42	219	.71	219	.59	219	.77	219	.67	205	.49		
Tot.	Post-CST							410	.75	410	.72	410	.46	410	.72	410	.64	410	.83	410	.68	409	.66	162	.59
4	Rec. Sta.									201	.58	201	.45	201	.52	201	.45	201	.59	201	.47				
Test A	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	Rec. Sta.											201	.50	201	.44	201	.56	201	.67	201	.50				
Test B	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	Rec. Sta.													201	.40	201	.46	201	.52	201	.39				
Test C	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	Rec. Sta.															201	.46	201	.47	201	.37				
Test D	Pre-CST															219	.34	219	.40	219	.30	205	.32		
	Post-CST															410	.31	410	.51	410	.28	409	.47	162	.40
8	Rec. Sta.																	201	.56	201	.50				
Test E	Pre-CST																	219	.38	219	.24	205	.19		
	Post-CST																	410	.44	410	.40	409	.34	162	.34
9	Rec. Sta.																			201	.59				
Test F	Pre-CST																			219	.42	205	.40		
	Post-CST																			410	.47	409	.57	162	.45
10	Rec. Sta.																								
Test G	Pre-CST																					205	.34		
	Post-CST																					409	.48	162	.36
11	Rec. Sta.																								
EOCA	Pre-CST																								
	Post-CST																							162	.78

Table 15

Intercorrelation Table for Unit and Organizational Supply Clerk

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

Table 16

Intercorrelation Table for Cooks

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 AFQT	Rec.Sta.			192	.70	194	.64	194	.48	194	.51	194	.60	194	.48				
	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 SRT (RGL)	Rec.Sta.					193	.78	193	.68	193	.53	193	.71	193	.56				
	Pre-CST					187	.80	187	.76	187	.59	187	.73	187	.61	172	.59		
	Post-CST					217	.73	217	.64	217	.53	217	.67	217	.48	216	.60		
3 JRTT Tot.	Rec.Sta.							195	.83	195	.73	195	.80	195	.75				
	Pre-CST							322	.86	322	.75	322	.91	322	.77	298	.55	135	.62
	Post-CST							298	.81	298	.70	298	.89	298	.78	295	.53	81	.74
4 Test A	Rec.Sta.									195	.58	195	.68	195	.51				
	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 Test B	Rec.Sta.											195	.64	195	.40				
	Pre-CST											322	.65	322	.44	298	.38	135	.46
	Post-CST											298	.59	298	.41	295	.46	81	.51
6 Test C	Rec.Sta.													195	.46				
	Pre-CST													322	.52	298	.48	135	.56
	Post-CST													298	.49	295	.50	81	.69
7 Test D	Rec.Sta.																		
	Pre-CST															298	.48	135	.44
	Post-CST															295	.33	81	.59
8 EOCA	Rec.Sta.																		
	Pre-CST																	126	.56
	Post-CST																	79	.71

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				

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 indicate 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-job-related measures of reading, are as effective as the JRTT in predicting academic achievement in job 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 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 jobs in which a number of men were administered the Job Knowledge tests of Chapter 4. For the Cook's, 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 job. Table 14, Column 12, presents comparable data for the Post-CST Repairman. In all cases, the *r*s 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.

Difficulty of Job-Related Printed Materials in Relation to Reading Ability

In the present research, one of the questions of interest concerned the reading difficulty levels of the reading materials cited by the men as having been used in conjunction with their job activities.

To determine these difficulty levels, copies of the publications cited during the interview were obtained. For the Repairman and Cook jobs, copies of publications which were cited five or more times were obtained. For the Supply Specialist job, where there were few publications cited, the researchers obtained a copy of the most frequently cited reference and copies of a number of other publications which were reported by supply sergeants to be of importance and in general use in the supply field.

The modified Flesch readability formula developed by Farr, Jenkins, and Paterson (2) was used to assess the reading difficulty levels of the job publications. The term "readability" refers to the comprehensibility of a publication—that is, how easy it is to read and understand it.

The readability analyses are summarized in Table 18, which shows the total number of publications and pages sampled in each job, the range of reading difficulty levels found over all pages, and the average grade level or readability of materials in the jobs.

The average grade level of readability of materials is shown graphically in Figure 5. Included also is an indication of the average reading grade level scores of a sample of Army personnel working on different tasks within each of the jobs (these data were obtained in the course of the work which is described in Chapter 5). The reading ability data are provided separately for high aptitude and low aptitude men.

Table 18

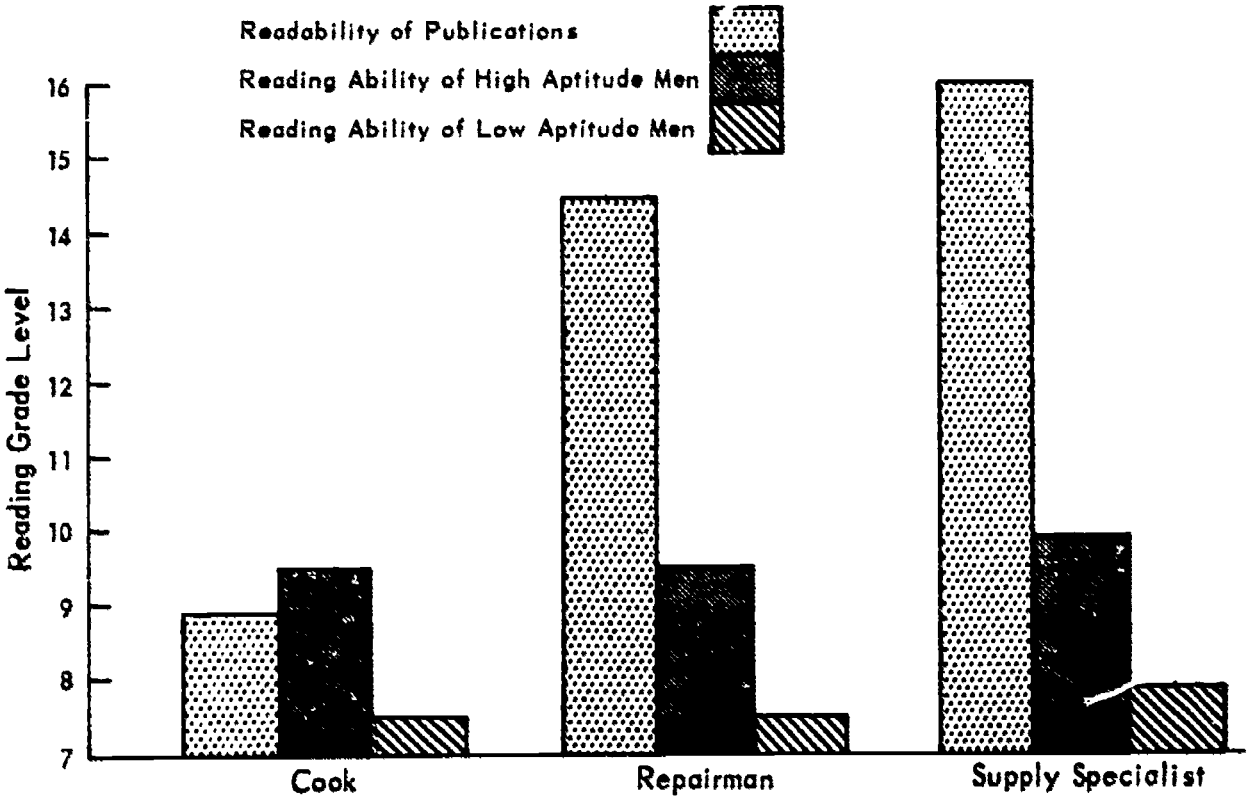
Readability Scores for Publications in Three Army Jobs

Job	Number of Publications	Number of Pages Sampled	Range of Flesch Readability Levels – SGE[a]	Average Readability SGE[a]
Supply Specialist	11	64	8.5 – 16+	16+
Repairman	8	244	7.0 – 16+	14.5
Cook	6	100	6.0 – 14.5	9.0

[a]SGE=School Grade Equivalent

Figure 5

Readability of Publications and Reading Ability of Job Incumbents



Making the visual comparisons between readability and reading ability suggested in Figure 5, it is noted that the difficulty level of printed materials for the Supply Specialist and Repairman positions exceeds the average reading achievement levels of the high aptitude job incumbents by about five to six grade levels. For the Cook job, however, difficulty level of the printed job materials and the reading achievement level of the high aptitude personnel are almost numerically matched. The low aptitude Cooks present an average reading achievement level that falls only about two grade levels below the reading difficulty level of their materials. Since the readability formula provides a roughly accurate index of the difficulty of the materials, Figure 5 suggests that both high and low aptitude personnel would experience considerable difficulty in reading and comprehending the Supply and Repairman job materials.

Readability, Reading Ability, and Readership

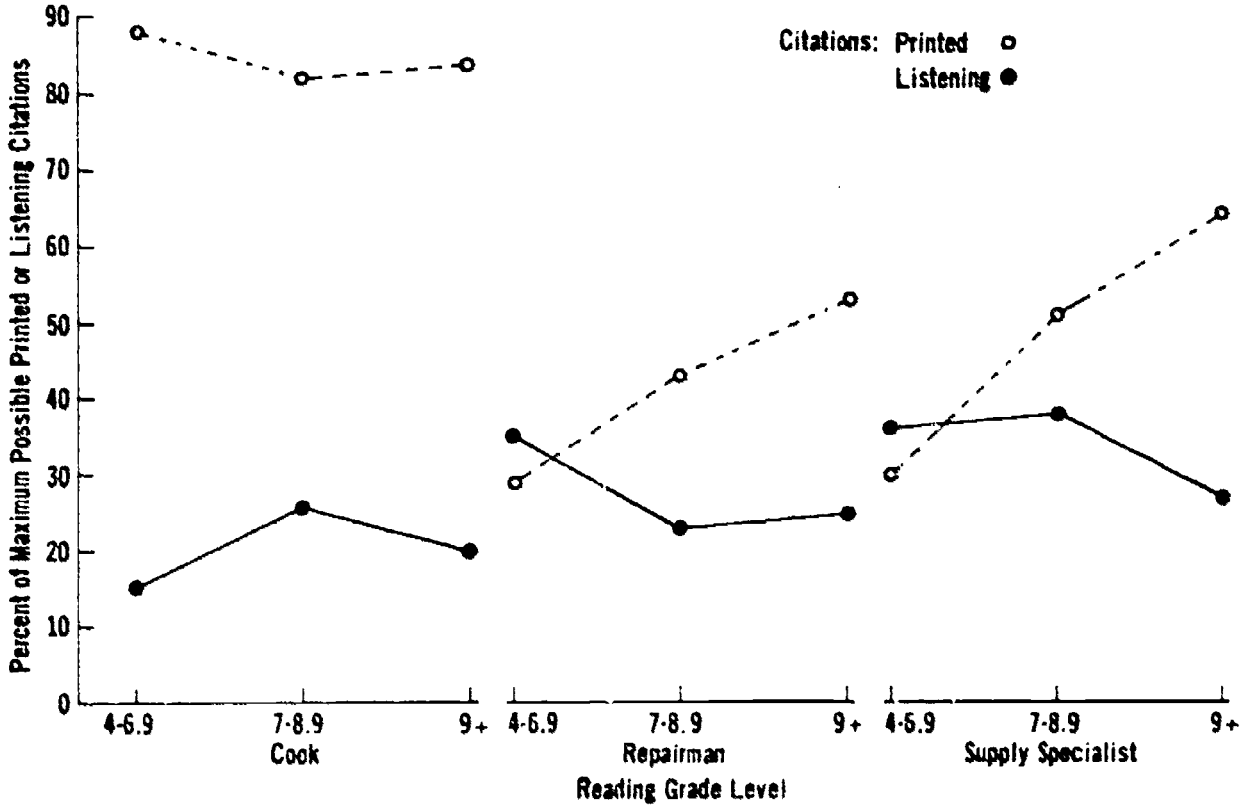
In the fields of journalism and advertising, the effects of the reading difficulty level of materials on the readership of the materials has been examined. Such study has indicated that, if materials are written at too high a level of difficulty, the number of people who read them may drastically decline. For this reason it was of interest to find out whether the gap between the reading ability of the men in a job and the reading difficulty level of the job printed materials might influence the extent to which men reported the use of job-related reading materials. It was thought that men of poorer reading ability might avoid reading material and instead tend to listen or ask for job information to a greater extent than the more able readers.

Data bearing on the readership and extent of listening are presented in Figure 6 for men of three reading skill levels and for Supply Specialist, Repairman, and Cook jobs. The readership index expresses the number of printed citations as a percentage of the maximum number possible if each man had given his full limit of five. Thus, a readership index of 20 means that the particular group of men produced, on the average, one citation of the use of printed material out of a possible five requested; an index of 40 would mean they produced an average of two printed citations out of the five requested, and so on. The listening index was computed in the same manner as the readership index by presenting the number of listening citations actually reported as a percentage of the maximum number of citations possible.

Statistical analyses and the data of Figure 6 indicate that for the Supply Specialist and Repairman a clear relationship exists between reading ability and the reported use of job related materials—the more able the reader, the greater the reported use of printed materials. For Supply Specialist, readers in the grades 4-6.9 reading group gave only 30% of the maximum possible citations of use of printed materials, contrasted with nearly 65% of maximum citations for the group of readers in the grades 9+ range. For

Figure 6

Citation of Reading and Listening Information Sources by Reading Ability Level



Repairman, the readership increased from 30% to 50% of maximum as a function of reading ability. It is notable that the Cook group reported a high (> 80%) incidence of use of printed materials, and this was independent of reading ability. A possible reason for this will be discussed later.

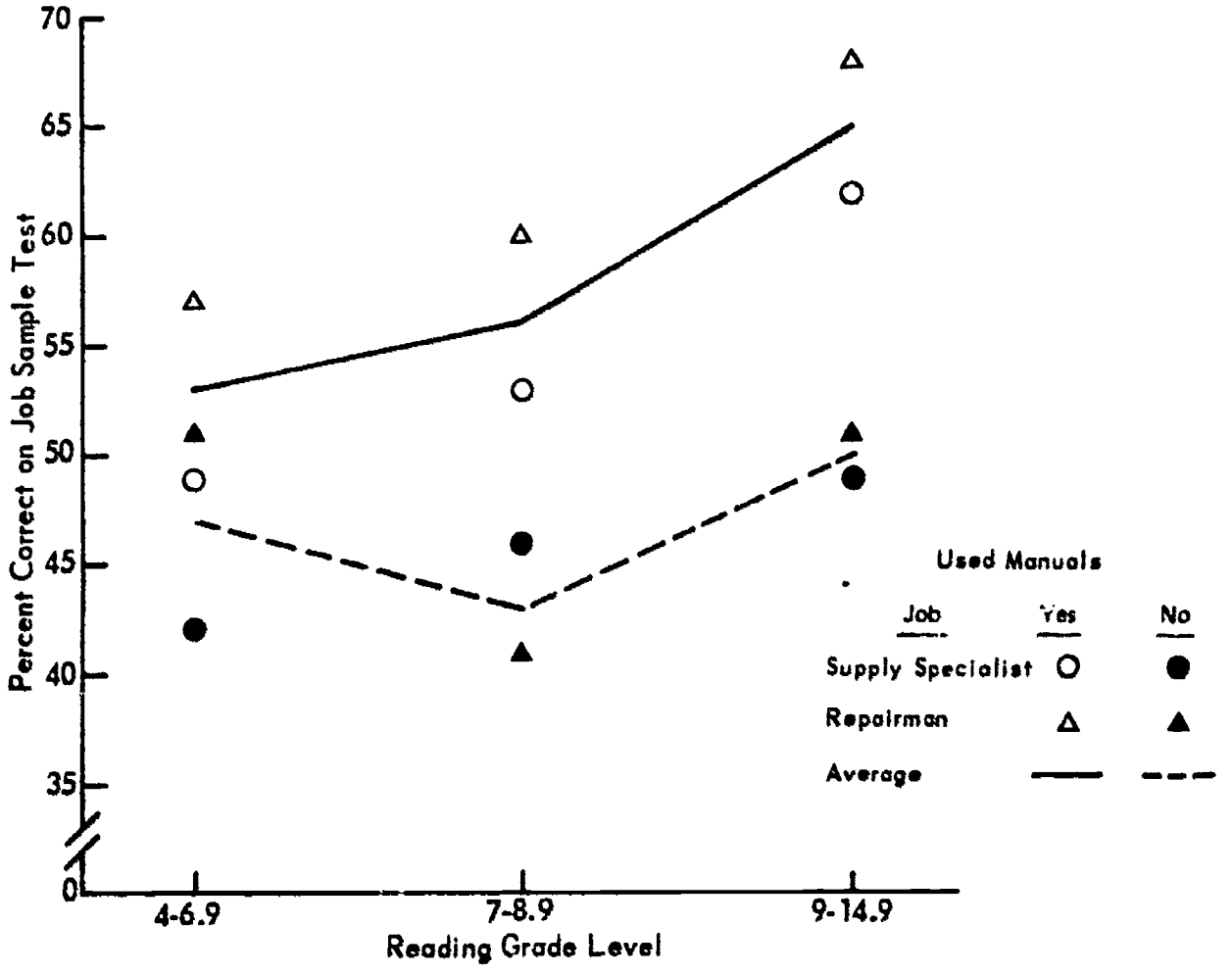
The data for listening indicate a fairly constant use of listening over the three level groups in each job. In the Supply Specialist and Repairman jobs the listening index is slightly higher than the readership index for the lower reading groups. However, with these small groups, these differences are not statistically reliable.

The data show a remarkable degree of consistency. In addition, the relationships observed among reading ability, readability, readership, and listening appear to follow a logical course. When reading materials are difficult, as in the Repairman and Supply Specialist jobs, there is less tendency for readers of any level to use the materials, although the men of higher reading ability will use them more than the less able readers. If the job materials are quite difficult, and the man cannot read very well, he may seek proportionately more of his information from others, rather than from reading the job materials.

While these data indicate that better readers are more likely to use manuals, the question still remains as to whether the use of manuals aids job performance. Data concerning reading ability, the use of manuals, and *job performance* were obtained in the work described in Chapter 4. In that research, job incumbents were administered three- to five-hour Job Sample tests in which Repairmen actually repaired vehicles and Supply Clerks worked in simulated offices filling out forms and counting equipment. In these Job Sample tests, job manuals were available so that men who were being tested could use the manual if they wanted. Figure 7 shows relationships between reading ability, use or non-use of manuals, and

Figure 7

Job Sample Test Performance as a Function of Reading Ability and Use of Technical Manuals



performance on the Job Sample tests for Supply Specialists and Repairmen. It is apparent that men who used manuals did better than those who did not use manuals regardless of reading ability. Furthermore, of those who used manuals, performance was better for the more highly literate men.

The present data on readability, reading ability, and readership across the three jobs suggest that *greater usage of job reading materials might be stimulated both by improving literacy skills of the men and by the redesign of reading materials.* Furthermore, the data for the Cook job suggest that greater gains in readership might be expected from the redesign of materials than from increasing the literacy skills of men. In this regard, much research on the construction and evaluation of various job performance aids has indicated that by following a systems approach, materials printed for the job can be designed which greatly improve the effectiveness of job incumbents across a spectrum of aptitude. It seems likely that the provision of such aids would also increase the utilization of job printed materials (see Chapter 7 for a discussion of job aid development).

Reading Ability and Use of Arithmetic on the Job

Table 19 summarizes the data on the use of arithmetic in these jobs. The arithmetic citations, like the readership and listening index numbers, are stated in terms of percentage of possible citations. Table 19 also indicates

Table 19

Use of Arithmetic as a Function of Reading Ability

(Use of Arithmetic is in Percent of Maximum Citations Possible)

Job	Reading Level	Arithmetic Citations (Percent)	Percent of Citations Using:			
			Whole Numbers	Decimal/ Fractions	System of Measure	Measurement Tool[a]
Repairman	9+	15	5	5	27	63
	7–8.9	6	9	0	27	64
	4–6.9	9	8	0	0	92
Supply Specialist	9+	38	32	9	54	5
	7–8.9	33	73	0	27	0
	4–6.9	28	71	0	29	0
Cook	9+	32	33	0	63	4
	7–8.9	29	35	0	65	0
	4–6.9	33	29	0	68	3

[a]Ruler, gauge

the nature of the arithmetic comprising the citations made by men. Thus, Repairmen with a reading level of 9+ gave only 15% of the maximum possible citations of the use of arithmetic. Of these few citations, 5% involved the use of whole numbers, another 5%, decimals or fractions, 27%, some system of measurement (i.e., a money system, changing inches to feet, pounds to ounces) and 63%, the use of a measurement tool (such as a ruler or a gauge). In the Repairman job, the use of gauges (torque wrenches, air pressure gauges, etc.) represented the primary use of arithmetic.

Of special note in the Supply Specialist job is the lower incidence of use of whole numbers by higher reading ability men, and their higher frequency of use of a system of measurement. The data indicate that the higher reading ability men tend to work more with the money system in the Supply field than do the less able readers. The latter in turn do mostly simple counting tasks involving whole numbers. The Cook job data bear out the importance of systems of measurement in the use of recipe books. This was true regardless of reading level.

Overall then, these data indicate a fairly low usage of arithmetic in these jobs. When used, however, the nature of the arithmetic task is likely to be different for each job, and, in the case of the Supply Specialist, for different reading ability groups. Thus we find that Repairmen use mostly gauges, while Cooks use the measurement systems involved in preparing recipes. In the Supply Specialist job, men of low or average reading ability do simple counting, and men of higher reading ability work with the money system and accounting.

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. The figure shows the percentage of men tested at the reception station who are at or above three different criterion levels of performance on the JRTT in relation to the reading ability level of the men as determined by the SRT. This provides an indication of the level of reading skills required to perform job reading tasks.

The vertical broken line in each section of Figure 8 designates a reading skill level of 8.0, a level frequently referred to as *functional literacy* (a considerable increase from the 4.0 grade level of functional literacy established in World War II). The data for the Cooks show that 100% of the people who read at the eighth grade level would pass the criterion score on the Cook reading test whether this criterion was set at 50%, 60%, or 70% correct. For the Repairman reading tasks, however, of those reading at the 8.0 level only 70% would be expected to surpass the 70% correct criterion level. For the Supply reading tasks, the situation worsens, since only 20% of

persons with a reading level of 8.0 would be expected to get 70% correct. Thus there are clear differences in the reading skills needed for men not trained in the job to use the printed materials from the three jobs. This is discussed in the next section.

Readability of Materials and Reading Task Performance

The foregoing analyses substantiate the data on the difficulty of materials presented earlier, where it was indicated that the reading difficulty of the Supply material was higher than that of the Repairman, which in turn was more difficult than that of the Cook (Figure 5). The data for job reading task performance (Figure 8) appear to substantiate the readability data, in that the Cook's material appears to impose less difficulty than the Repairman's, which in turn is less formidable than that of Supply.

With regard to job reading material, then, the need for advanced reading skills appears to be greatest for the Supply Specialist job, with the Repairman and the Cook jobs following in that order. If one were to consider a functional reading level to be one at which 80% of the readers would be expected to get 70% of the job reading task items correct, then functional literacy for Cooks would be in the range of grade levels 7.0—7.9, for Repairmen, 8.0—8.9, and for Supply Specialists, 12-12.9!

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 an 8th grade level would be required for Cooks, 10th for 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, such as the information regarding relationship of reading ability to job proficiency, to be discussed next in Chapter 4.

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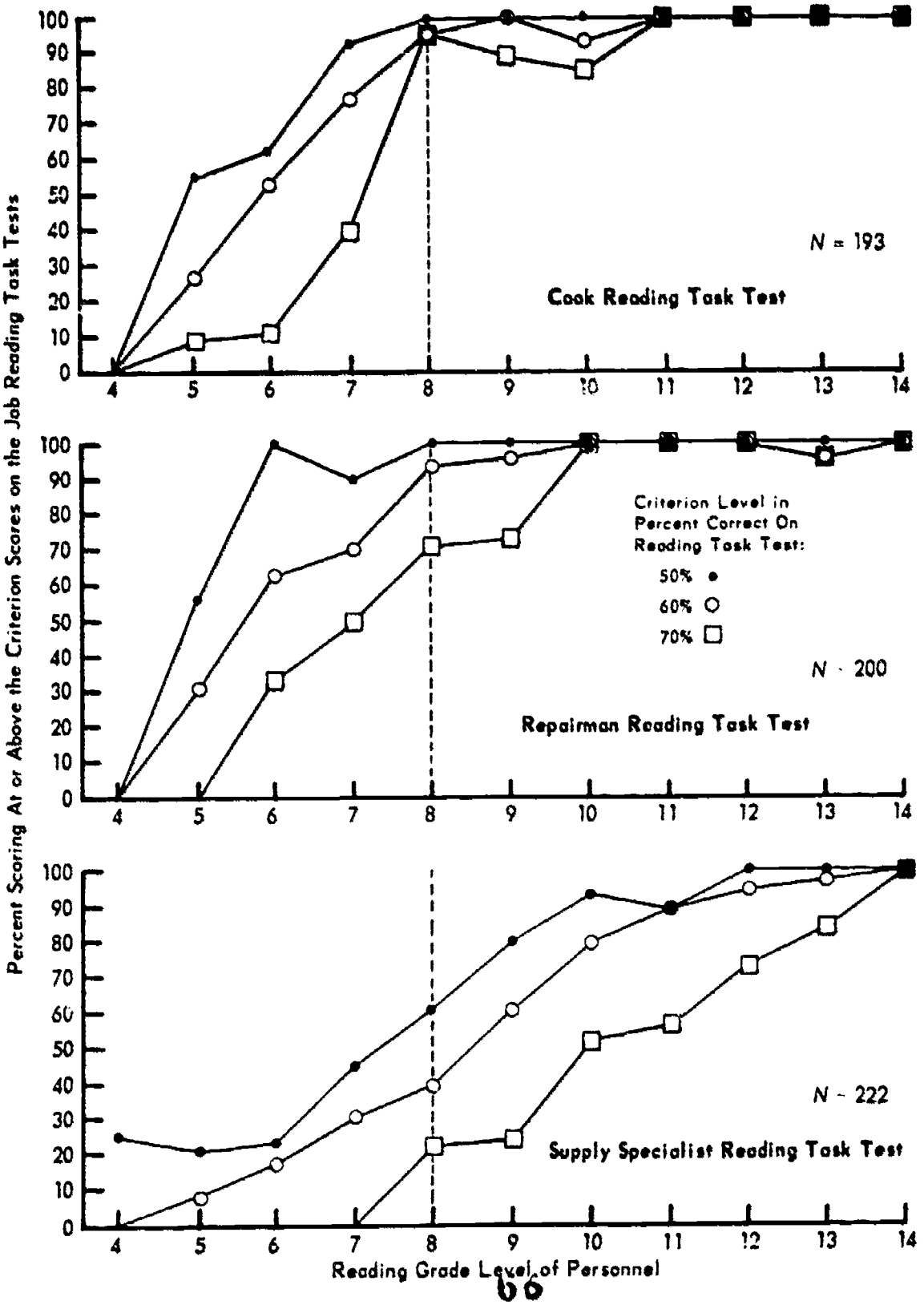
Figure 8

Men at Each Reading Grade Level Reaching Different Criterion Levels On Reading Task Test *(Percent)*



Chapter 4

Literacy in Relation to Job Knowledge, Job Performance, and Supervisor Ratings

In Chapter 3 relationships between performance on job reading task tests and on a standardized reading achievement test were examined. For Repairman, Supply Specialist, and Cook, correlation coefficients for job reading task performance and performance on the standardized reading test were fairly large. This was not unexpected, inasmuch as both tests were explicitly designed to tap reading skill, with the purpose of identifying levels of reading skills needed to adequately utilize job reading materials.

This chapter[1] is directed toward the examination of relationships between three literacy variables (reading, listening, arithmetic) and three indexes of job proficiency which were *not* designed to tap reading skills, at least not in a direct manner. The job proficiency indexes include: job knowledge (paper-and-pencil tests), job performance (hands-on job sample tests), and supervisor ratings.

It was anticipated that reading skill would be more highly related to the paper-and-pencil tests than to the job sample performance tests. It was also expected that substantial relationships might be found between hands-on performance tasks and literacy skills because both require some degree of language facility. However, in the case of job sample performance, it was recognized that (as data reported in Chapter 3 indicated) men frequently learn and perform job tasks by watching and talking with

Based on Chapter 4 of HumRRO Technical Report 71-23, *Determination of Literacy Skill Requirements in Four Military Occupational Specialties*, by Thomas G. Sticht, John S. Caylor, Richard P. Kern, and Lynn C. Fox, November 1971.

[1] The psychometric and job proficiency data used in this chapter were obtained under HumRRO Work Unit UTILITY, to which study the literacy measures of REALISTIC were appended in the interests of efficiency of data collection. Our indebtedness to the UTILITY staff, and in particular to Dr. Robert Vineberg and Dr. Elaine Taylor, is gratefully acknowledged. Of course, responsibility for the data analyses and interpretations of this report rests with the authors.

others. In such cases, listening is a more relevant language reception skill than reading. Hence a listening test was included in the battery of literacy tests. We also included an arithmetic test in the literacy battery to assess ability in the use of a highly formal language system.

RESEARCH SUBJECTS

The subjects of this research worked in the three jobs previously considered (Repairman, Supply Specialist, and Cook). In addition, men in a fourth job, Armor Crewman, were studied. Men in all four of these jobs were being studied under another HumRRO research program, Work Unit UTILITY,[1] and the present literacy measurement requirements were appended to that effort. In keeping with the design for Work Unit UTILITY, subjects were high (AFQT > 30) and low (AFQT < 30) aptitude men who were paired with regard to the amount of time they had worked on the job. However, for the present purposes the only importance of this pairing procedure was that the lower aptitude men were over-represented in the sample. For this reason the figures presented for literacy skill levels should not be construed as parameters of the general Army population.

The four jobs which were studied were selected on a variety of criteria:

(1) They represent a range of types of job skills.

(2) They are high density jobs to which a substantial portion of low aptitude men are assigned.

(3) Except for Armor Crewman, these Army jobs have close counterparts in the other services as well as in the civilian society.

The nature of these jobs is apparent: Cooks prepare food in accordance with a master menu and detailed recipes; Supply Specialists requisition and issue supplies and maintain records—primary clerical tasks; Repairmen diagnose and repair motor vehicles; and the Armor Crewmen operate the tank and its weapons systems—a substantially procedural set of tasks.

These jobs differ widely in the number of job-related reading tasks involved in job performance, as well as in the literacy and arithmetic requirements for entry. For each, the training program contains a large amount of reading material and, for each, extensive manuals are available as part of the job equipment.

[1] Detailed description of the UTILITY rationale, procedures, subjects and test materials is given in references 1, 2, and 3.

LITERACY AND OTHER PREDICTOR MEASURES

Reading—To assess reading skills, the Survey of Reading Achievement, Junior High Level (grades 7-9) developed by the California Test Bureau was used. This test was chosen because (a) it provides a composite index of reading skills expressed in school grade equivalents; (b) grade placement norms span a wide range of abilities (grades 4.0-14.5), a necessary characteristic when testing men whose AFQT scores range from the 10th to the 99th percentile; (c) it has a testing time of 40 minutes which could be accommodated within the testing schedule.

Arithmetic—Arithmetic skills were measured by use of the Survey of Arithmetic Achievement, Junior High Level, California Test Bureau, a companion test to the reading instrument and selected for the same reasons.

Listening—Listening skills were measured by a non-standardized experimental test constructed for this project. It consists of three short descriptive passages presented orally on tape. After each passage, 12 questions, calling for information contained in the passage, are read aloud twice, and after each question the subject is required to write his single word or short phrase answer. When the passages are regarded as reading material, they fall at the 6th, 7th, and 14th grade level of reading difficulty.

AFQT—The Armed Forces Qualification Test (AFQT) is a measure of trainability which is used as a "screening" measure for acceptance into all our armed services. It consists of 25 multiple-choice items in each of four areas: *Verbal*, vocabulary; *Arithmetic*, simple word problems; *Shop Mechanics*, matching line drawings of tools and mechanical equipment according to function; and *Pattern Analysis* or form perception. Corrected for guessing, scores from the four sections are pooled and converted to percentile ranks (see page 74).

JOB PROFICIENCY MEASURES

The job proficiency measures were developed in conjunction with Army content experts. There were three different measures of job proficiency (see reference 3, for a more complete description of these measures).

Job Knowledge—The job knowledge measures were multiple choice tests (ranging from 75 to 96 items in length) for different job areas. These tests were made up of samples of knowledge considered by experienced job occupants to be important for competently fulfilling the job. The test items were selected for relevance to job performance, not to school training. Since these were paper-and-pencil tests, the need for reading skills was inherent in the task.

Job Sample—Job sample tests were constructed so as to represent the key tasks, in terms of essentiality, frequency, and urgency, typically performed by men in the jobs. For the most part they do not directly test reading skills, but they do represent what men *do* in these jobs. Also, the tests were not free of verbal demands since the instructions were presented orally. Hence the listening component of literacy was inherent in the testing situation, though not necessarily involved in the job task per se.

The tests were administered by trained testing crews, at special test sites, using full normal job equipment. Cooks cooked on field ranges; Supply Specialists worked in a fully equipped mock-up supply room; Repairmen repaired trucks and tanks; Armor Crewmen performed in tanks, simulating only the firing of weapons. In short, the job sample performance tests were hands-on samples of job tasks performed in a given career field.

Supervisor's Questionnaire—Each subject was rated by his immediate supervisor who had been instructed by the study staff that his ratings would be used for research purposes only and would have no administrative effect on the subject. Ratings were obtained on two rating scales: (a) the Standard Army Enlisted Evaluation Report, consisting of five- or six-point scale ratings on 14 attributes such as conduct, job performance, cooperativeness, reliability, job knowledge, and responsibility; and (b) an experimental scale on 12 items such as, "Does he need more supervision on the job than most?" and "If you could, would you just as soon replace him?" Since the two rating scales correlated .80, scores of the two scales were summed to increase the reliability of the supervisory rating measure of job proficiency in this study.

RESEARCH FINDINGS

The ultimate objective of the data analysis is to determine how well performance on one or more of the predictor variables predicts performance on the various job proficiency measures. First, however, it is informative to note how performance on the literacy tests and AFQT was distributed in the groups of men studied in the four jobs.

Table 20 shows number and percentage of men at various levels on the three literacy tests and the AFQT. These figures are for the four jobs combined. It is interesting to note that, although half the total sample was from AFQT Mental Category IV, less than 10% of the population read below the 6.0 grade level, and fewer than 18% performed below the 6.0 grade level in arithmetic. Also, although 25% of the persons in our sample had AFQT scores in the 1-20 range, only 2% of the subjects read below the 4.9 grade level. This contrasts with Department of Defense data (4) which indicated that, out of 46,000 "new standards" men (primarily men

with AFQTs in the 10-20 range) tested at the Armed Forces Entrance Examination Centers, some 31% read below the 4.9 level.

Table 20

Distribution of Subjects by Literacy and AFQT Level
(Percent)

Reading		
Score[a]	*N*	%
4–4.9	31	2.0
5–5.9	108	6.9
6–6.9	228	14.6
7–7.9	328	21.0
8–8.9	233	14.9
9–9.9	273	17.5
10–10.9	168	10.7
11–11.9	55	3.5
12–12.9	83	5.3
13 & up	57	3.6
Total	1564	

Arithmetic		
Score[a]	*N*	%
4–4.9	38	2.4
5–5.9	238	15.2
6–6.9	295	18.9
7–7.9	424	27.1
8–8.9	184	11.8
9–9.9	142	9.1
10–10.9	74	4.7
11–11.9	52	3.3
12–12.9	37	2.4
13 & up	80	5.1
	1564	

Listening		
Score	*N*	%
1–4	22	1.4
5–8	51	3.3
9–12	146	9.3
13–16	308	19.7
17–20	381	24.3
21–24	353	22.6
25–28	230	14.7
29–32	73	4.7
33–36	0	0
Total	1564	

AFQT		
Score	*N*	%
1–10	24	1.5
11–20	374	23.9
21–30	384	24.6
31–40	190	12.1
41–50	139	8.9
51–60	141	9.0
61–70	131	8.4
71–80	75	4.8
81–90	73	4.7
91–100	33	2.1
	1564	

[a]Score=School Grade Equivalent.

Using 31% as the expected proportion of men to be found in the 10-20 AFQT and who have reading scores below 4.9, we would expect 123 of our sample of 398 men with AFQT scores of 10-20, to score below 4.9. Instead, as Table 20 indicates, only 31 men out of 1564, including 398 lower Category IV men, read in the 4.9 or below ranges. Apparently, the very low reading, lower mental Category IV men do not well survive the additional screening imposed by job training and early job experience. Since these very low readers are, in large part, missing from our sample, relationships between literacy variables and job proficiency should be viewed as attenuated and, in general, as underestimates of the true relationships between literacy and job proficiency.

Differences among the four jobs in performance on the literacy tests are presented in Table 21. This table shows the percentage of men in each job who scored below the grade 7.0 level on the reading and arithmetic tests, and below a raw score of 13 on the experimental listening test. With regard to reading, the percentage of men reading below the grade 7.0 level in the Supply Specialist job is less than one-half that of the Cook, where fully one-third read below the 7.0 level. The Repairman and Armor Crewman jobs occupy a midpoint between Supply Specialist and Cook.

Table 21

Men Scoring Below Grade Seven on the Reading and Arithmetic Tests and Below Score Thirteen on the Listening Test

Literacy Test	Job							
	Supply Specialist		Armor Crewman		Repairman		Cook	
	N	Percent	*N*	Percent	*N*	Percent	*N*	Percent
Reading	65	16.1	81	21.0	94	23.7	127	33.3
Arithmetic	118	29.4	156	40.6	146	36.9	151	39.6
Listening	42	10.4	41	10.7	20	5.1	116	30.3

It is interesting to recall from Chapter 3 that the reading materials in the Supply Specialist job are most difficult, and the Cook the least difficult, with the Repairman in between. If men were being assigned to these three jobs on the basis of the reading difficulty of the materials, the assignment would reflect the reading achievement distributions in Table 21. That is, since Supply Specialist has the most difficult reading materials, it would not be desirable to assign many of the poorer reading men to that career field. However, since the Cook reading materials are

much easier, men of lower reading abilities could be assigned to that job. Possibly then, the classification of men into these career fields would take into account, at a judgmental level, the reading demands of the job.

A further index of the differences among the jobs is the performance on the listening test. Approximately one-third of the Cooks scored 12 or below on this test, as compared to 5 to 10% of the men in the remaining jobs. Differences in terms of arithmetic performance are not pronounced, although Supply Specialist again showed the fewest men in the lower skill range. The data of Table 21 suggest that the literacy demands may be greatest for Supply Specialist, about equal for Armor Crewman and Repairman, and least for Cook. This is consistent with the findings reported earlier in Chapter 3.

INTERRELATIONSHIPS AMONG LITERACY MEASURES

Table 22 presents an intercorrelation matrix for literacy variables, selected personal background variables, and the AFQT. The data in Table 22 show that reading, arithmetic, and AFQT—all tests requiring reading ability—are substantially intercorrelated. This is not surprising since one-quarter of the AFQT is vocabulary and one-quarter arithmetic word problems. These three tests show similar profiles over the other predictors. Listening, a verbal but non-reading test, presents a somewhat attenuated version of this pattern.

Table 22

Intercorrelations of Predictor and Selected Background Variables Summed for Four Jobs

Variable	Variable						
	1	2	3	4	5	6	7
1. Reading	–	.69	.65	.54	.30	−.04	−.27
2. Arithmetic	.69	–	.61	.43	.34	−.10	−.22
3. AFQT	.65	.61	–	.47	.26	.01	−.30
4. Listening	.54	.43	.47	–	.12	.00	−.22
5. Education	.30	.34	.26	.12	–	.01	.12
6. Age	−.04	−.10	.01	.00	.01	–	.11
7. Race[a]	−.27	−.22	−.30	−.22	.12	.11	–

[a]For computing the correlations with race, Caucasian was assigned the code number of 0, and Negro the code number of 1.

With regard to literacy and personal background factors, Table 22 shows positive relationships of reading and arithmetic to education in our sample. Age is not correlated to any extent with any of the other variables, while the negative coefficients for race with the various measures of cognitive skills suggest that English-speaking Caucasians score somewhat higher on these language-oriented measures than non-Caucasians or Caucasians from homes where standard English may not be the predominant language.

INTERRELATIONSHIPS AMONG JOB PROFICIENCY MEASURES

A second group of variables of interest is the job proficiency measures, the job knowledge and job sample test scores, and the supervisor ratings. The interrelationships of these variables determine to what extent these measures describe a man's job proficiency in a similar fashion. If tests agree in describing proficiency, men who score high on the job knowledge test would be expected to score high on the job sample test and supervisor rating. Thus, high correlation coefficients indicate that men are being ranked about the same from one index of proficiency to another. Low coefficients indicate that tests are ranking men in a different manner, with perhaps little agreement from test to test. This may be evidence that the criterion measures are sampling different aspects of job proficiency.

Before the interrelationships among the measures of job proficiency are considered, it should be pointed out that, because of the wide range of job proficiency of men in the sample, and the high correlation of job proficiency to time on the job, the proficiency scores have been adjusted statistically, using regression-based scores estimated from the logarithm of time on the job, to remove the effects of job experience. Hence all of the relationships we discuss are freed of the influence of time on the job.

Table 23 presents the interrelationships among the adjusted proficiency measures. As indicated, the relationships are consistent from one job to the next. The coefficients between job knowledge and job sample are higher than those for either knowledge or job sample with the supervisor ratings. This suggests that the knowledge and sample tests are sampling more of a common aspect of proficiency than the aspect of proficiency reflected by the supervisor rating. The fairly large (.64) coefficient for the supply field between knowledge and job sample reflects the commonality of the paper-and-pencil aspects of the man's job performance and the paper-and-pencil aspects of the job knowledge test. Overall then, the job knowledge and job sample performance tests appear to be sampling some similar aspects of job proficiency, while the supervisor rating is largely an independent estimate of job proficiency.

Table 23

Intercorrelations Among Adjusted Proficiency Measures

Adjusted Proficiency Measure	Job			
	Armor Crewman	Repairman	Supply Specialist	Cook
Knowledge/Performance	.50	.50	.64	.50
Knowledge/Supervisor Rating	.21	.18	.29	.27
Performance/Supervisor Rating	.13	.16	.24	.20

INTERRELATIONSHIPS BETWEEN PREDICTOR AND CRITERION VARIABLES

The intercorrelations of predictor and criterion variables, with the latter statistically adjusted to be freed of the effects of time on the job are listed in Table 24. The supervisor ratings are not related to any of the

Table 24

Correlations Between Predictors and Job Proficiency Measures

Job	Predictor	Job Proficiency Index		
		Job Knowledge	Job Performance	Supervisor Ratings
Armor Crewman	AFQT	.55	.37	.07
	Reading	.57	.32	.06
	Arithmetic	.49	.31	.14
	Listening	.53	.29	.06
Repairman	AFQT	.44	.32	.16
	Reading	.47	.26	.17
	Arithmetic	.39	.24	.14
	Listening	.40	.38	.09
Supply Specialist	AFQT	.36	.37	.09
	Reading	.40	.40	.10
	Arithmetic	.34	.36	.09
	Listening	.35	.42	.11
Cook	AFQT	.49	.37	.15
	Reading	.56	.34	.11
	Arithmetic	.44	.31	.13
	Listening	.39	.28	.07

predictor variables to any meaningful degree. Hence, the prediction of job proficiency when measured by the supervisor rating is not feasible with any of these predictor variables and will not be treated further in this report.

The data for job knowledge scores indicate that, across all four jobs, job knowledge is most closely related to reading and AFQT, and less closely related to arithmetic and listening (with the exception of the Supply Specialist). For job sample performance, however, all of the literacy variables and the AFQT are lower in predictive precision. Thus, the data indicate that the literacy variables predict job measures, which place a heavy demand on reading, better than they predict job sample data, which demand little direct application of reading although general language demands persist.

The correlation coefficients indicate the overall relationships among the predictor and criterion variables. Perhaps a more meaningful and useful indication of the relevance of reading skills for job proficiency may be obtained by considering Figure 9. Segments were constructed for each reading level by determining the percentage of men in *that* reading level who scored among the bottom 25% (fourth quarter), next-to-the bottom 25% (third quarter), next-to-the top 25% (second quarter), and top 25% (first quarter) of all those men who took the tests. Thus, each of the bars shows the proportion of men at that reading level who scored in each of the four quarters of job proficiency. The sum of the proportions in each bar is 100%, which accounts for all of the men at a given reading level.

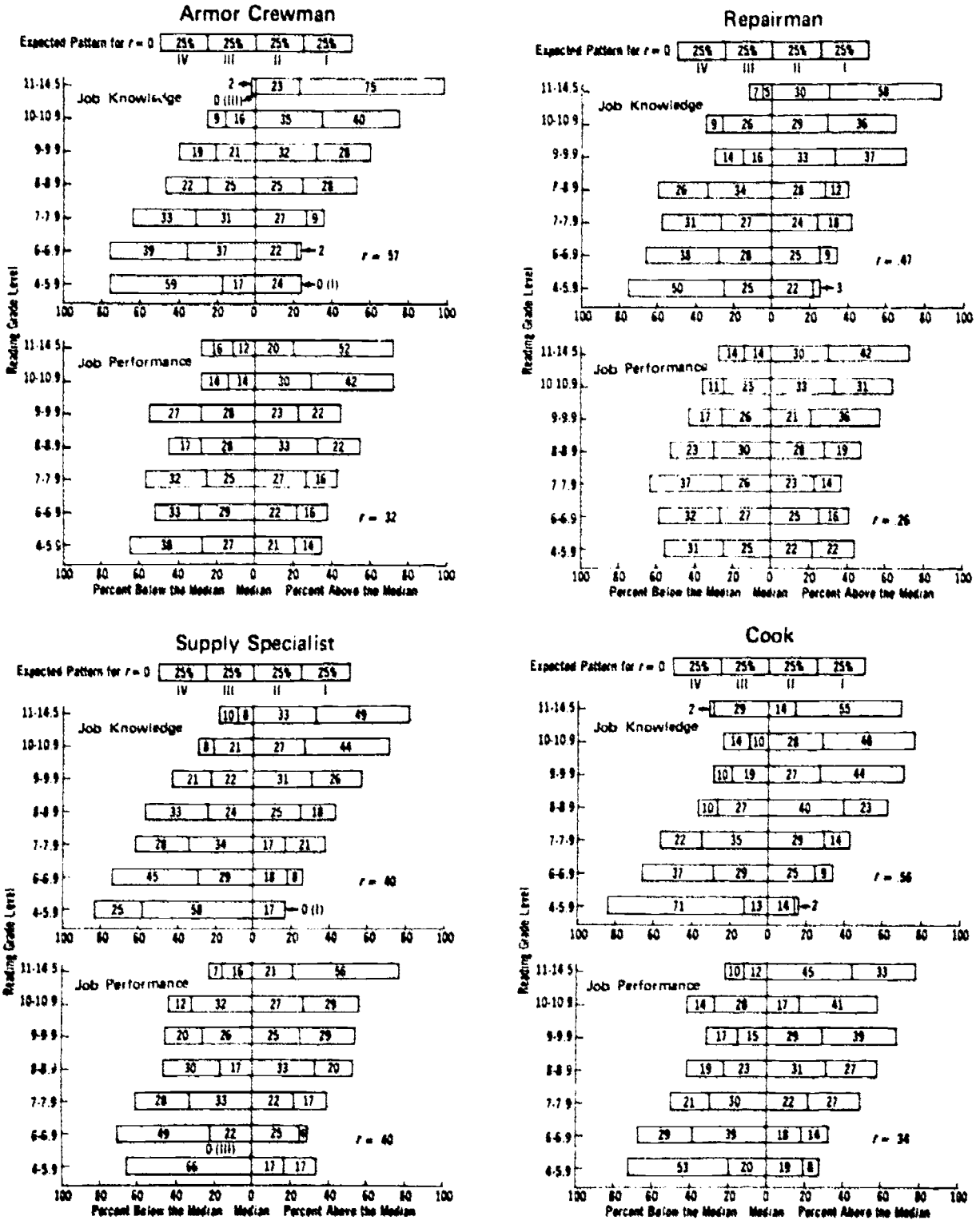
In the figure, the bar at the top of each segment indicates the proportion of men that would be expected in each quarter (25%) if the correlation of job proficiency and reading was 0. Over-representation in any quarter is indicated by a score greater than 25%, while under-representation is indicated by a score less than 25%. Under- or over-representation, especially in the bottom and top quarters, is expected when the literacy-job proficiency correlation is greater than zero. The numbers within each division show the proportion of persons at that reading level who are in the designated quarter.

The segment of the figure that deals with job knowledge and performance for Armor Crewmen shows that 98% of the men who read at the 11-14.5 level scored above the median on the knowledge test. Furthermore, 75% were among the best (top quarter) of those who took the job knowledge test. Looking at the lowest reading level, the figure shows that only 24% of men in the 4-5.9 reading level scored above the median on the job knowledge test. None was in the first quarter. On the other hand, 59% of the poorest readers performed at the level of the bottom 25% of their fellow job incumbents who took the knowledge test.

Referring to these data, the probabilities associated with placement in the fourth, third, second, or first quarter on the two proficiency tests can

Figure 9

Quarter Distributions of Job Knowledge and Performance by Reading Grade Level: Comparison of Four Jobs



be determined as a function of reading ability. For instance, in Supply, the probability is .66 (66 times out of a hundred) that the score of a man who reads in the 4-5.9 level will fall in the bottom quarter of job proficiency when measured by the job sample performance test. These probabilities are, respectively, .38, .31 and .53 in reference to job sample performance for the Armor Crewman, Repairman, and Cook. The probabilities in job knowledge are: Armor, .59; Repairman, .50; and Cook, .71.

READING REQUIREMENTS FOR FOUR JOBS

In principle, all of the men tested were successful job performers by virtue of the fact that they were actively serving in a job position at the time of testing. This is somewhat analogous to saying that persons who hold a high school diploma can, by definition, read at the 12th grade level. In actuality, however, a student's reading level is defined in terms of his reading test performance *relative* to other people in the other school grades.

In a similar fashion, we can describe *adequate* job proficiency in terms of the relative proficiency of job incumbents. Thus, the data of Figure 9 show relative job proficiency for men at each reading level. That is to say, the men in the bottom quarter are there because their proficiency was poorer than three-fourths of the other men.

We find, however, that because of the significant correlations of reading and job proficiency, the different reading levels are disproportionately represented in the four quarters, especially in the top and bottom quarters. As the bar at the bottom of the figures indicates, if there were no correlations of reading and job proficiency, we would expect to find 25% of the people at each reading level in the bottom quarter, 25% in the third quarter, and so forth. This suggests a decision rule for determining the reading level to be specified for each job. The rule is to select the lowest reading level for which representation in the bottom quarter does not exceed 25%, that is, the level of representation that would occur if reading ability did not count (r=0).

Applying the above rule to the data for Armor Crewman (Figure 9) we find that, for job knowledge, 33% of the people who read at the 7-7.9 level are in the bottom quarter, while only 22% of those who read at the 8-8.9 level are in the bottom quarter. Thus, a reading level of approximately 8.0 grade is indicated as a targeted reading level for the Armor job when job knowledge is the criterion. Examination of the job sample data tends to confirm this level. There we find that 32% of the people reading at the 7-7.9 grade level are among the bottom job performers, while only

17% of the readers at the 8-8.9 grade level are in the bottom quarter. Again, then, an 8.0 grade level of reading appears to prevent over-representation in the bottom quarter.

Similar analyses (with some latitude for anomalies) applied to the job knowledge and job sample data for the Supply Specialist, Repairman, and Cook jobs (Figure 9) suggest reading levels of 9.0, 8.0, and 7.0, respectively. It should be noted that these levels rank the jobs in the same order as the reading task test criterion (Figure 8, Chapter 3). That is, Supply Specialist is most demanding of reading skills, the Repairman is next, and the Cook is least demanding. Furthermore, this is consistent with the data of Table 21 which shows 16% of the Supply personnel scoring at the 7.0 reading level or below, while 23% of the Repairmen and 33% of the Cooks scored at or below the 7.0 grade level. This suggests that classification and/or attrition due to job demands has acted to restrict the number of poorer reading men in the Supply and Repairman jobs.

When similar analyses are performed for the arithmetic and listening data (Figures 10 and 11), the indicated level of arithmetic skills for Repairmen, Supply Specialists, and Cooks is 7.0-7.9, while for Armor Crewmen a 6.0-6.9 level appears to suffice. For listening, scores in the 16-18 range appear sufficient to prevent disproportionate representation in the lowest quarter of job proficiency for both Armor Crewmen and Cooks. For Repairmen and Supply Specialists, scores in the 19-21 category appear to be associated with "adequate" job proficiency, as defined by representation in the lowest fourth of job incumbents. The increased demand for listening skill in the Supply Specialist and Repairman jobs, in contrast to that for the Cook, is consistent with the differences in reading requirements for these jobs. This suggests a greater need for general language skills in the Supply Specialist and Repairman fields.

Figure 10

Quarter Distributions of Job Knowledge and Performance by Arithmetic Grade Level: Comparison of Four Jobs

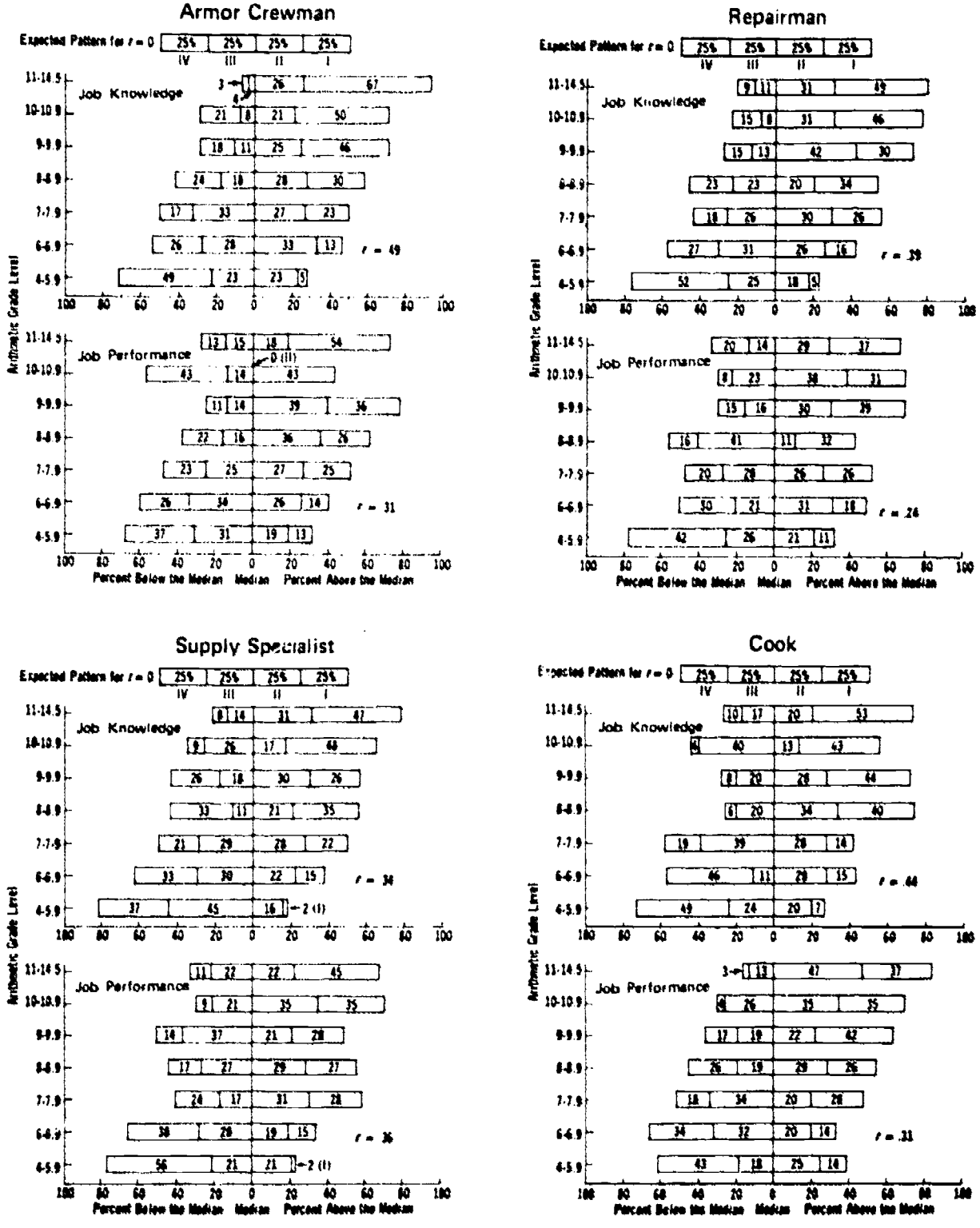
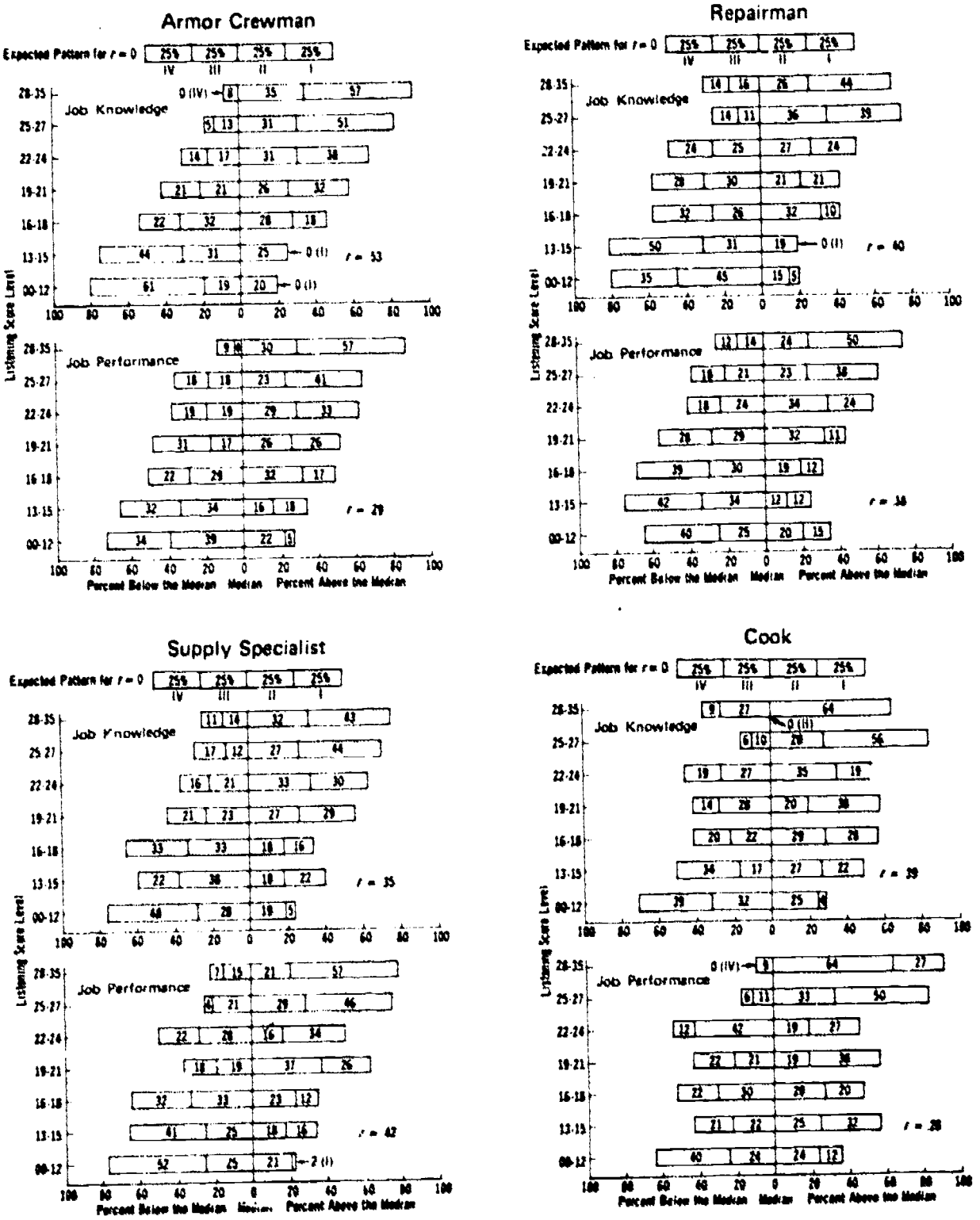


Figure 11

Quarter Distributions of Job Knowledge and Performance by Listening Score Level: Comparison of Four Jobs



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Note on AFQT Categories:

The percentile scores for the Armes Forces Qualification Test have been grouped to form five Mental Categories. A person having an AFQT score of 30 has scored better than 29% of the people who have taken the test. In this volume we sometimes talk about Category IV and Non-Category IV personnel. Category IV personnel are those who have scored between the 10-29th percentiles on the AFQT, while Non-Category IVs are personnel who score at or above the 31th percentile.

Mental Category	AFQT Percentile
I	93-100
II	65-92
III	31-64
IV	10-30
V	0-9

Chapter 5

Using Personnel Data Files to Estimate Reading Demands of Jobs

ELEMENTS IN ESTIMATING READING REQUIREMENTS

A procedure using data from existing personnel data banks for estimating functional literacy requirements of jobs 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, 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 job.

Reading Scores

Except for a few special cases, 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. Data from Chapter 4 indicate that, for approximately 1,500 job incumbents of widely varying job experience in four jobs, the AFQT-standardized reading test correlation was .65. For three 200-man groups of unselected recruits in a Reception Station, median r was .79 (Chapter 3). For men entering Career Skills Training (CST) in three jobs, the median r was .75, as it was for three samples of about 200 men each upon completion of CST (Chapter 3). An r of .68 was found in another Reception Station sample of 395 recruits; in this case, a different standardized reading test was used (1).

Based on Chapter 3 of HumRRO Technical Report 73-5, *Methodologies for Determining Reading Requirements of Military Occupational Specialties*, by John S. Caylor, Thomas G. Sticht, Lynn C. Fox, and J. Patrick Ford, March 1973.

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 or similar test scores, 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, Enlisted Evaluation Test (EET) score provides, in existing Army data files, the only direct, objective assessment of a man's proficiency in his job. The EET (based upon multiple-choice, job-knowledge items) is centrally revised, administered, and scored by the Army Enlisted Evaluation Center. The score on the 125-item test 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 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 EETs are set by the management agencies for each job, in conference with the Enlisted Evaluation Center. Such criterion scores are based jointly on a consideration of the distribution of proficiency scores in the EET, the best judgment of management 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 present research that such criteria *are* in existence, and thus we have the elements in existing, standard records for estimating reading level requirements of the Army jobs—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.

PROCEDURE

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

(1) Select the jobs to be studied.

(2) Select a sample of men in that job.

(3) Extract AFQT, and EET scores from existing records for each member of the sample.
(4) Compute the mean EET scores for men at each AFQT decile.
(5) Ascertain the lowest AFQT level at which the criterion level is met.
(6) Convert that AFQT level to a reading grade level equivalent using the standard regression equation provided in this chapter.

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

Selecting Jobs

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

The following jobs were chosen for study:

Light Weapons Infantryman
Field Radio Repairman
Wheel Vehicle Mechanic
Personnel Specialist
Armor/Unit Supply Specialist
Medical Specialist
Military Policeman

Selecting Personnel Sample and Obtaining Scores

For each of the seven jobs, a sizable sample of EET data was obtained, and for each job, the Enlisted Evaluation Center (EEC) provided the following data for a sample of 400 men:

- Name
- Social Security Account Number
- Pay Grade
- Enlisted Evaluation Test Score
- Minimum Passing EET Score established by management for the job

From these samples, a subset of 100 men was selected for each job in order to provide a full range of EET scores *with a heavy concentration of subjects in the region of the minimum passing score on the EET established by management for that job.* AFQT scores for these men were extracted from their files at the U.S. Personnel Services Support Center. Between the varying dates of EET testing in the different jobs and the time of the search of the personnel files, a considerable interval had elapsed. To varying degrees in the different jobs, 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 files were not available were replaced from the 400-man rosters by substitutes with EET scores as nearly equivalent as possible. In the Wheel Vehicle Mechanic job, in particular, there were insufficient low-scoring EET substitutes available from the 400-man sample to provide the intended distribution of EET scores. This somewhat tortuous tryout procedure resulted in a set of approximately 100 subjects in each of the jobs who were distributed on AFQT and EET as shown in Table 25. The minimum passing EET score set by management for these jobs is also shown in this table.

Table 25

Percentage Distributions of AFQT, EET, and MPRTS Scores

Test	Job						
	Infantry (N=107)	Electronics (N=98)	Mechanic (N=100)	Personnel (N=101)	Supply (N=98)	Medical (N=99)	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
EET							
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 jobs in the proportions of men at a given EET score level reflect only a decision to *oversample* in the region of the minimum passing test score. Beyond showing a wide range of EET scores with greatly fluctuating sampling density in each job, these EET distributions have no further independent meaning. Similarly, the AFQT distributions do not represent random samples of that variable in these jobs and are presented only to show the range and relative frequency of AFQT scores in these present data.

Relating EET to AFQT and Reading Ability

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

To ascertain how EET performance varied with AFQT, mean EET scores were computed for men at each decile of AFQT (Table 26). These data were then smoothed by computing weighted EET means for adjacent AFQT deciles, and a least squares best linear fit was applied to the resulting values in each job.

Shown immediately below the AFQT level designations in Figure 12 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

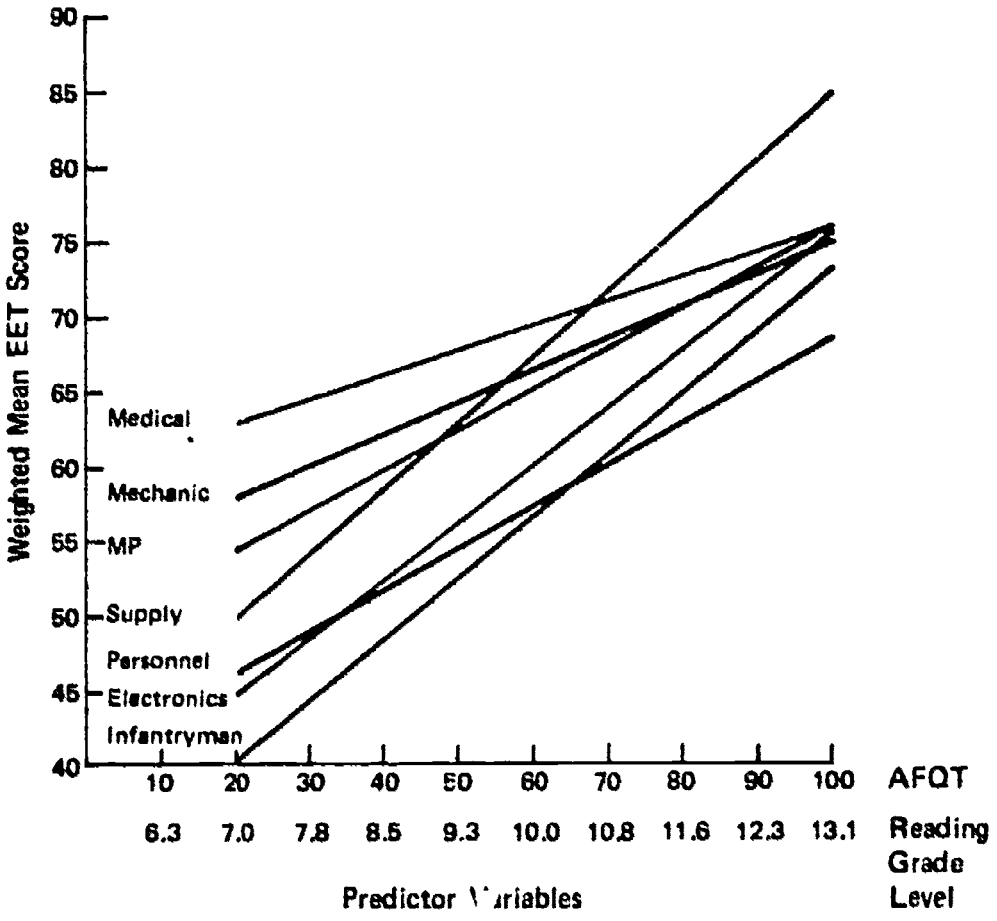
Table 26

Mean EET Scores by AFQT Decile

AFQT	Job						
	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	58.7
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

Figure 12

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



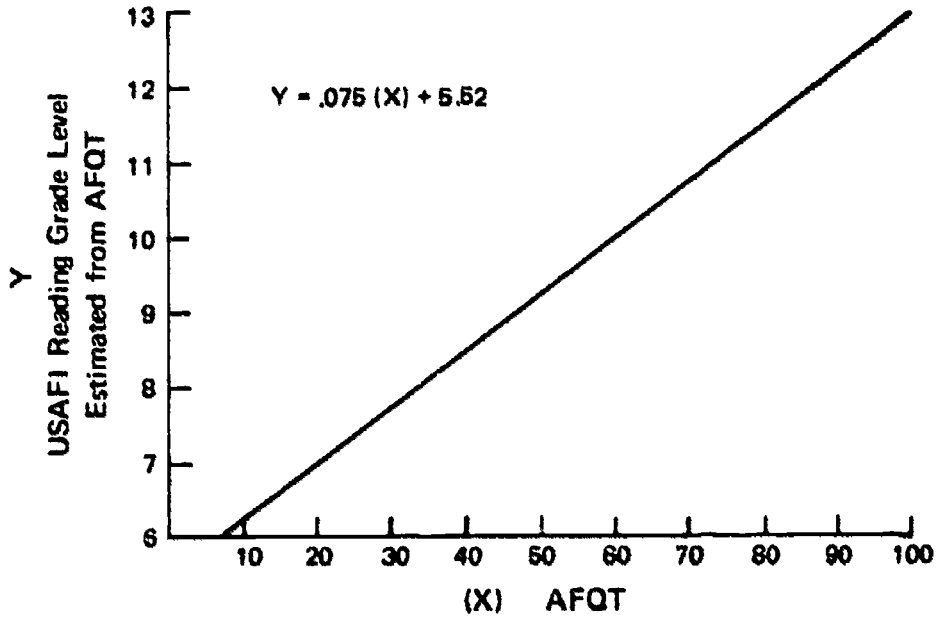
unselected recruits at the Fort Ord Reception Station in which the correlation between AFQT and RGL scores on the USAFI Achievement Tests III (Abbreviated Edition) Form A was .68. The RGLs estimated from the AFQT by the regression equation [estimated USAFI = .075 (AFQT) + 5.52] are shown in Figure 13.

From Figure 12, the estimated reading level requirements for the seven jobs can be read off directly—provided that one has a criterion level of an EET score defining satisfactory performance.

As mentioned earlier, in present practice, management for each job field defines a criterion by setting a minimum passing EET score as *one* requirement for an incumbent's maintaining his job classification. For the Light Weapons Infantryman, the criterion level for 1971 was set at 43. In looking at Figure 12, it can be seen that by entering the EET ordinate

Figure 13

Regression of USAFI Reading Grade Level on AFQT



at 43, then moving right until encountering the Infantryman's line, and then moving vertically down to the abscissa, an average EET score of 43 is obtained at an AFQT score of 26. By interpolation of the bottom line of Figure 12 (or from Figure 13) one can see that for AFQT 26, the corresponding reading grade level is 7.5. Thus, the reading requirement for Infantryman is determined as being at the seventh- to eighth-grade level of reading ability.

Each job has its own Enlisted Evaluation Test and its own minimum passing score established by its management. Table 27 shows the minimum passing test scores for the seven jobs and their reading-grade-level requirements determined as above. For Wheel Vehicle Mechanic and Military Policeman, minimum passing EET scores are set so low that it precludes determining the reading requirement of the jobs any more precisely than below the seventh-grade reading level. For the other jobs, the reading requirement ranges from 7.5 to 9.9. Men reading below the reading level requirements for their job do not, on the average, meet this minimum-criterion level of job proficiency on the mandatory EET.

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

Table 27

Job Reading Requirements Under Various Criteria

Job	MPTS[a]	RGL[b]	EET Items Correct		
			60	65	70
Infantry	43	7.5	10.3	11.1	12.0
Electronics	60	9.8	9.8	10.8	11.7
Mechanic	42	[c]	7.6	9.4	11.1
Personnel	57	9.8	10.6	11.9	13.0
Supply	59	8.1	8.3	9.2	10.0
Medical	65	8.6	6.6	8.6	10.7
MP	46	[c]	8.5	9.9	11.3

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

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 jobs is truly minimal. Table 27 illustrates the effects of increasing the EET criterion on the estimated reading requirements. Data are presented for criterion scores of 60, 65, and 70 items correct on the EET.

Considering that these criterion levels respectively represent 48, 52, and 56% of the maximum possible score on the test, the reading level requirements rise sharply in these jobs 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 EET job-knowledge items are rarely passed.*

At the 60-items-correct criterion level, literacy requirements differ considerably over jobs, ranging from reading grade levels 6.8 to 10.5. Differences between jobs 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

job knowledge. At higher criterion levels, job reading requirements increase and differences between jobs shrink as the effective ceiling is approached.

The level of reading required for a job 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.

The purpose of establishing the job reading requirement for a job 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 jobs can be fully manned by men already possessing the literacy skill levels required by these jobs for satisfactory job performance. Rather, the establishment of job 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 jobs for which data of Figure 12 permit a determinate solution, the job 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 indicate that such training should minimally aim at producing seventh-grade reading ability (see Chapter 8).

References for Chapter 5

1. Caylor, John S., Sticht, Thomas G., Fox, Lynn C., and Ford, J. Patrick. *Methodologies for Determining Reading Requirements of Military Occupational Specialties*. HumRRO Technical Report 73-5, March 1973.

Chapter 6

Commentary on Methodologies for Determining Literacy Demands of Jobs

In Part I of this book we have described four different methods used to estimate the reading demands of Army jobs. In this chapter, we summarize these methods, as well as other methods used by job analysts, and offer some critical comment on the relative merits of the various techniques for estimating literacy demands of jobs.

ASSESSING JOB READING REQUIREMENTS

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, 1), 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 jobs studied in Part I are given in Column 5 of Table 28.

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

Based on Chapter 5 of HumRRO Technical Report 73-5, *Methodologies for Determining Reading Requirements of Military Occupational Specialties*, by John S. Caylor, Thomas G. Sticht, Lynn C. Fox, and J. Patrick Ford, March 1973.

Table 28

Reading Requirements of Jobs Determined by Seven Different Methods

Job	Stated Requirement in AR 611-201[a]	DOT Code	DOT/ GED	DOT/ RGL	Read-ability	CTB[b]/ Job Know.	CTB/ Job Sam-ple	CTB/ JRTT	USAFI/ EET
1	2	3	4	5	6	7	8	9	10
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
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	–	–
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+	–	–	–	–
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
General 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	8	<7
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

(Continued)

Table 28 *(Continued)*

Reading Requirements of Jobs Determined by Seven Different Methods

Job	Stated Requirement in AR 611-201[a]	DOT Code	DOT/ GED	DOT/ RGL	Read-ability	CTB[b]/ Job Know.	CTB/ Job Sam-ple	CTB/ JRTT	USAFI/ EET
1	2	3	4	5	6	7	8	9	10
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	11[c]	9	9	10	8.1
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
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	–
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.

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 are given in Column 2 of Table 28.

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.

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 the work reported in Chapter 3, where, in the Cook's job, 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 jobs in Column 6 of Table 28. Materials for the Cook's job were identified by interviews with job incumbents. The remaining readability estimates are based upon formally prescribed materials to be read for job 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 job, 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 research of Part I, 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.

In applying either of the foregoing psychometric models, major decisions are encountered in selecting the measures of literacy and job proficiency. In the present 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 Chapter 4, in an attempt to accommodate the first type of "illiteracy," literacy was assessed using a nonreading, listening test. In the research of Chapters 2, 3, and 5, 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, 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 research of Part I examined relationships of reading ability to four different types of job proficiency involving tasks that vary in their demand for reading. Relationships between reading ability and performance on Job Reading Task Tests (JRTT) were examined (Chapter 3). Relationships were examined between reading ability and Proficiency on the Enlisted Evaluation Test (EET, Chapter 5). And 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.[1]

Thus, in the research of Chapters 3, 4, and 5, there are four criterion measures of Army job proficiency. The JRTT reflects proficiency in reading the materials reported by job incumbents in three jobs 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 job material and they ask the questions that the job incumbents reported asking. The job knowledge and EET paper-and-pencil 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), except when men chose to use the available technical manuals.

SELECTING A METHOD FOR ESTIMATING JOB READING DEMANDS

Which of the seven methods listed in Table 28 should be used to determine reading requirements of jobs? So far as we know, there is no

[1] Relationships between reading ability and supervisor ratings were also examined. However, the relationship was not sizable enough to warrant further consideration.

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 28, 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 28, Column 5) is also relatively low in cost, but it appears insufficient on at least three counts for the purpose of determining job reading requirements with useful precision:

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

(2) 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.

(3) There is no statement of the contemplated level of job proficiency for which the reading grade level (GED) is specified.

Five Empirical Methods

In sharp distinction to the DOT-RGL procedure, the five empirical methods of Table 28 (Columns 6 to 10) 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 jobs. Given data on the relationship between measures of reading and job proficiency, the specification of the reading requirement for a job 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 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 28, 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 28, 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 official Army documents as literature to study to prepare for job proficiency examinations was used in this research.[1] Systematic samples of reading passages from these sets clustered heavily at the 11th and 12th grade reading difficulty level for each of the seven jobs 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 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 official Army list of study materials seems an overly inclusive and demanding specification of printed materials that must be read and comprehended 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 job 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 job 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.

[1] The readability research of Chapter 2.

Job Knowledge and EET. The *job knowledge* method (Table 28, Column 7) is a standard, straightforward approach to determining the job reading requirements that can readily be adapted to use existing personnel data. In the basic paradigm (Chapter 4), it calls for preparation of a job knowledge test for the job 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 (Table 28, Column 10) used the Enlisted Evaluation Test (EET, Chapter 5) 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 jobs. An elementary computer program for ascertaining the lowest AFQT level at which EET 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 job for which the existing AFQT and EET data occur on a common data tape.

The illustrative job reading requirements generated by this method are keyed to the minimum passing test score criterion set by management for the job 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 a job, 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 job trainees 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 28, 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 job 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 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, on conjunction with the criterion cutoff assumed by the researchers, yields job 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 a job seem prohibitive for all but fundamental research purposes.

Job Reading Task Method. The *job reading task method* (Table 28, Column 9) represents the most direct empirical approach to determining job 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 job, the ability to read the JRTT passages *is* the ability to perform the job reading tasks and thus to meet the job 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 a job 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 subjects passed at least 70% of the JRTT items. Illustrative job reading requirements associated with this criterion level are presented in Table 28, Column 9.

SUMMATION

In summary, it must be explicitly recognized that the readability, job-knowledge, job-sample, JRTT, and EET 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 determination of which method is best depends upon the resources available to the analyst and the purpose of the analysis (e.g., to describe general goals for training; to identify curriculum elements; to state general reading requirements of a job). Because the job reading task test procedure provides the only direct measure of how well persons of various general reading levels can read job materials, we think it is the procedure of choice. It has the virtue of providing both an indication of the reading task to be performed *and* the general level of reading skill needed to perform the reading task at a specified criterion level. Also, despite a somewhat high cost, it could be applied to various career *fields* using clusters of jobs from career fields. From this approach, the JRTT is an economically feasible method of directly determining reading demands of jobs.

References for Chapter 6

1. Phillips, J. Edmond. *The Use of Training Time Information in Planning and Evaluating Manpower Programs*, Report from the California Occupational Analysis Field Center, Los Angeles, April 1970.

Part II

Reducing Discrepancies Between Literacy Skills of Personnel and Literacy Demands of Jobs

Introduction

As mentioned in Chapter 1, one strategy for coping with marginally literate personnel is to redesign the job or job training program to reduce the requirements for reading. A second strategy is to upgrade the reading skills of personnel through reading training.

In Part II we discuss research and development projects concerned with both of these strategies. Chapter 7 deals with methods for reducing the reading demands of jobs, while Chapter 8 describes an R&D program to develop a six-week reading training program that focuses on teaching personnel to read and use the reading materials they will encounter in their job training and on the job.

Chapter 7

Methods for Reducing Literacy Demands of Jobs

Research described in Chapters 2 and 3 focused on the differences between the reading difficulty levels of the printed materials available for performing a job and the reading ability levels of the men who are supposed to use these materials. Repeatedly it was found that the reading demands of the materials were considerably above the skill levels of the men in those jobs.

In this chapter we discuss two approaches for reducing the reading demands of jobs. In one approach, we consider the feasibility of substituting the spoken word for the written word. A series of basic research projects are described in which listening rather than reading is the primary means of gaining job information. In the second approach, we briefly describe procedures for simplifying and reducing the reading difficulty level of job reading materials to make it easier for less literate personnel to use them.

Reading vs. Listening[1]

Many studies have indicated that listening may be as effective as, or superior to, reading for some instructional purposes. Duker (1), in his annotated bibliography of over 800 articles on listening, comments on 33 studies that compared reading and listening test performance for children and adults. Of 15 studies using adult subjects (mostly college students), eight reported no differences in reading or listening test scores, six favored listening, and one reported that listening was best with narrative material, while reading was best with descriptive material.

Based on "Reducing Discrepancies Between Literacy Skill Levels of Personnel and Literacy Demands of Jobs," by Thomas G. Sticht, in HumRRO Professional Paper 19-71, *Project REALISTIC: Evaluation and Modification of REAding, LIStening, and ArithmeTIC Needs in Military Jobs Having Civilian Counterparts*, September 1971.

[1] The assistance of SP 5 Pat Ford in the conduct and analyses of data for these studies is acknowledged. A detailed report of this and related work is found in a HumRRO Technical Report (2).

In 18 articles annotated by Duker, children were the subjects. The general finding was that in the early grades (first through fourth or fifth) listening was likely to be more effective than reading, while in the higher grades reading became as effective, or more effective, than listening.

These studies suggest that, in some instances, listening might prove a more effective training technique than reading. To examine the feasibility of this idea, research was initiated to determine the relative effectiveness of reading and listening as means for instructing men of different aptitude levels, as determined by the AFQT. The possibility that listening might prove superior to reading in the case of the lower aptitude men was of particular interest.

To compare learning by listening with learning by reading, two comprehension tests, A and B, were administered to 96 Army inductees. Forty subjects formed a low mental aptitude group with a mean AFQT score of 18.25; 56 subjects formed an average mental aptitude group, with an average AFQT score of 63.

Both tests A and B served as reading and listening tests. Both had four subtests having a grade difficulty level of either 6.5, 7.5, or 14.5, as determined by a modified Flesch formula.

The low mental aptitude and average mental aptitude groups were split into two equal subgroups. One subgroup listened to test A and read test B, while the other subgroup listened to test B and read test A. In the analysis of results, the scores for the counterbalanced groups were combined. Reading and listening times were equated. The listening test was presented by means of a tape recorder, with gain adjusted to a "comfortable" listening level. Questions for the listening test were read aloud twice. Test questions demanded factual information and were of a "fill-in-the-blank" nature. The results of this comparison indicated that none of the differences between reading and listening within groups were statistically significant (Table 29). There was an overall decrease in performance as the difficulty level of the material was increased, but there was no interaction of mental aptitude with difficulty of material. There were, however, large differences between the two aptitude groups on both tests. This is not surprising, however, since the groups were based on AFQT scores, and such scores are derived from tests requiring considerable verbal and reading skills.

These data indicated that a variety of factual information may be communicated equally well through reading or listening to men of average and low aptitudes. Presenting materials via listening does not necessarily mean that the poorer reading man, found in the lower aptitude groups, will learn better by listening than by reading. If the material is too difficult, they do not learn much by either modality, and if it is simple, they learn equally well, as a group, by reading as by listening.

While the modality of presentation of information may not have much of a differential effect upon learning acquisition, there may be

Table 29

Scores for Low and Average Mental Aptitude Groups on Listening and Reading Subtests

Aptitude Group	Average Grade Level of Material					
	6.5		7.5		14.5	
	Listen	Read	Listen	Read	Listen	Read
Low Mental Aptitude (N = 40)						
Mean	52.87	51.68	52.46	42.98	25.48	26.02
SD	19.96	27.39	16.25	19.48	13.43	17.83
Average Mental Aptitude (N = 56)						
Mean	72.25	72.46	69.54	65.18	44.89	48.72
SD	19.93	21.04	15.88	18.45	19.76	20.63

differential motivating properties of listening and reading materials. In our work, for instance, 25% of a sample of some 300 men would prefer to learn by listening. Thus, providing listening materials might serve to motivate learning in a significant proportion of men.

RATE-CONTROLLED RECORDINGS (TIME-COMPRESSION OF SPEECH)

One drawback to listening for instructional purposes is that the listening rate is limited by the speaker's rate of speech, whereas in reading, one may vary his rate of information intake to suit the nature of the reading material. However, recent developments (reviewed in Foulke and Sticht, 3) have provided techniques that permit the speech rate of recorded passages to be speeded up or slowed down without otherwise changing the speech quality. Slowing the speech rate causes the time needed to present the message to increase; such speech is called time-expanded speech. Speeding-up the playback time of a recorded message results in the presentation of the message in less than the original recording time; therefore, accelerated speech is sometimes referred to as time-compressed speech.

To evaluate the possibility of using rate-controlled speech as a teaching medium for men inducted into the Army, studies were performed to compare men of low and high mental aptitudes with respect to their ability to comprehend speech presented at various rates. Previous research

(Foulke and Sticht), has indicated that the average oral reading rate for newscasters and professional readers for the blind is around 175 wpm, with a sigma of some 20-25 wpm. In the present research, speech rates ranging from two sigmas below the average (i.e., 125 wpm) to eight sigmas above the average (i.e., 375 wpm) were used. In addition to different speech rates, materials presented varied in difficulty as grades 5.5, 8.5, and 14.5 (modified Flesch formula of Farr, Jenkins, and Paterson, 4).

The results of this evaluation are shown in Figure 14, in terms of the percentage of correct responses on the cloze tests administered after the presentation of a tape-recorded story at various speech rates. The curves connecting the filled points are for lower aptitude men. Each point is the mean for an independent group of 17 men. The dotted lines drawn to the ordinate connect the experimental curves to baseline data obtained by testing control subjects without their listening to the experimental messages. The three levels of difficulty of the messages are represented as: circles = grade 5.5; squares = grade 8.5 and triangles = grade 14.5.

Analyses of variance performed on the data indicated a significant triple interaction of speech rate, message difficulty, and mental aptitude. Additional analyses indicated that the materials X speech rate interaction was significant for the low aptitude men, but not for the high aptitude men. Figure 14 shows that the gain in information across materials was constant for the higher aptitude men at the different speech rates, while the lower aptitude men showed a higher gain from the easier materials at reduced rates of speech.

With regard to the main effects of speech rate, these data indicate that speech rates of 350 wpm and above are distressingly fast, with comprehension returning to baseline or near baseline levels of performance for both aptitude groups. It is also of interest to note that the optimal speech rate for learning appears to be slower for the lower aptitude men than for the higher aptitude men. However, before such a conclusion is generally acceptable, replication is needed.

A further evaluation has been made of the comprehensibility of speech accelerated above 175 wpm. In figure 15 curves are shown that indicate how well men of high, medium, and low mental aptitude comprehended listening materials presented at 175, 275, or 425 wpm. These data show that, for speech rates of 275 wpm, comprehension declined only slightly from that at the normal 175 wpm rate for all three groups. Since the message presented at 275 wpm can be presented in 64% of the time required to present the message at the rate of 175 wpm, there is a 36% saving in time.

The fact that there was such a small loss in comprehension with a 36% saving in time suggested that the total amount learned could be increased by presenting the message twice in compressed form in the same amount of time required to present the message once in uncompressed form.

Figure 14

Listening Comprehension Test Scores for Messages on Three Levels of Difficulty Given at Different Rates of Speech

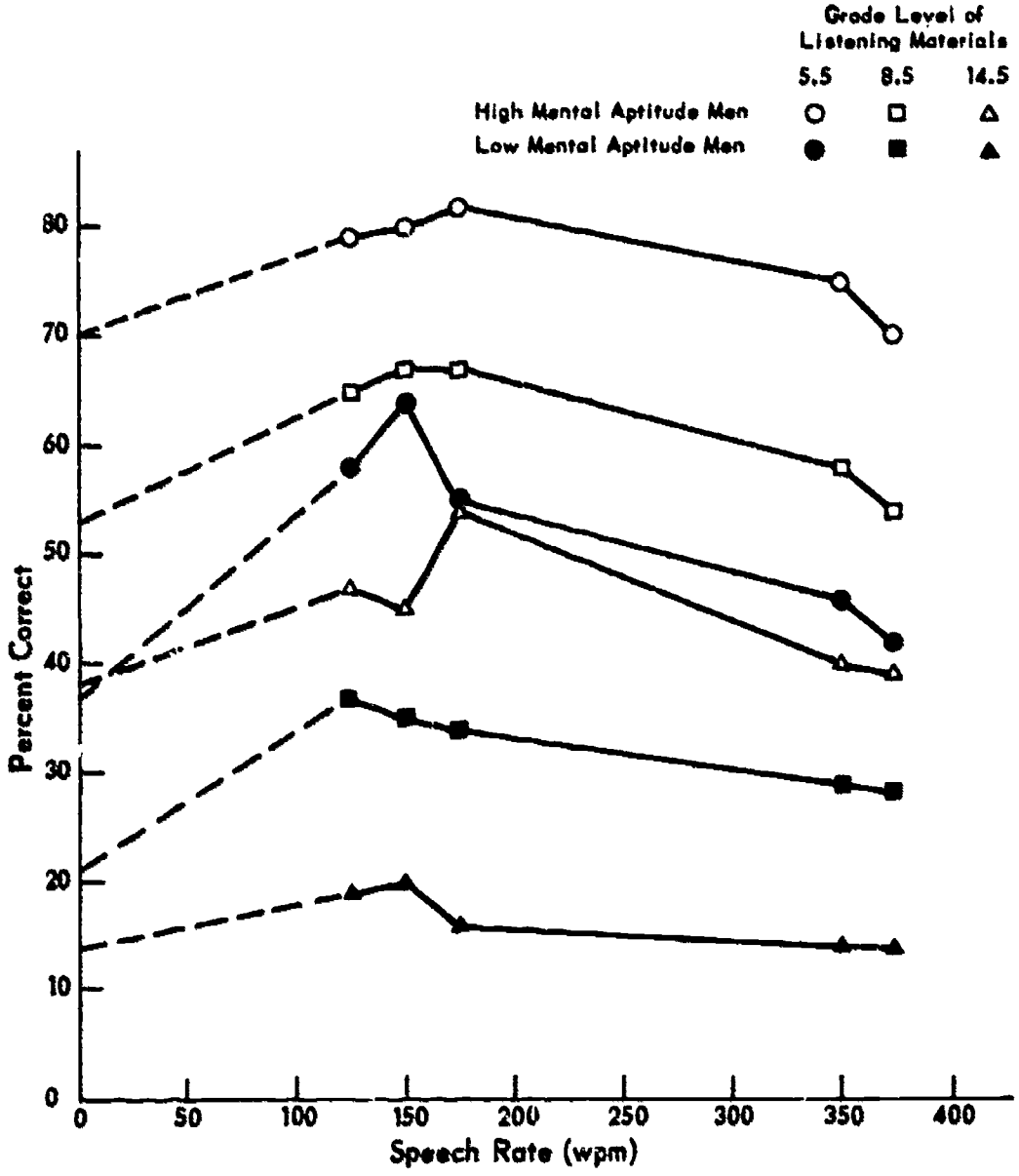
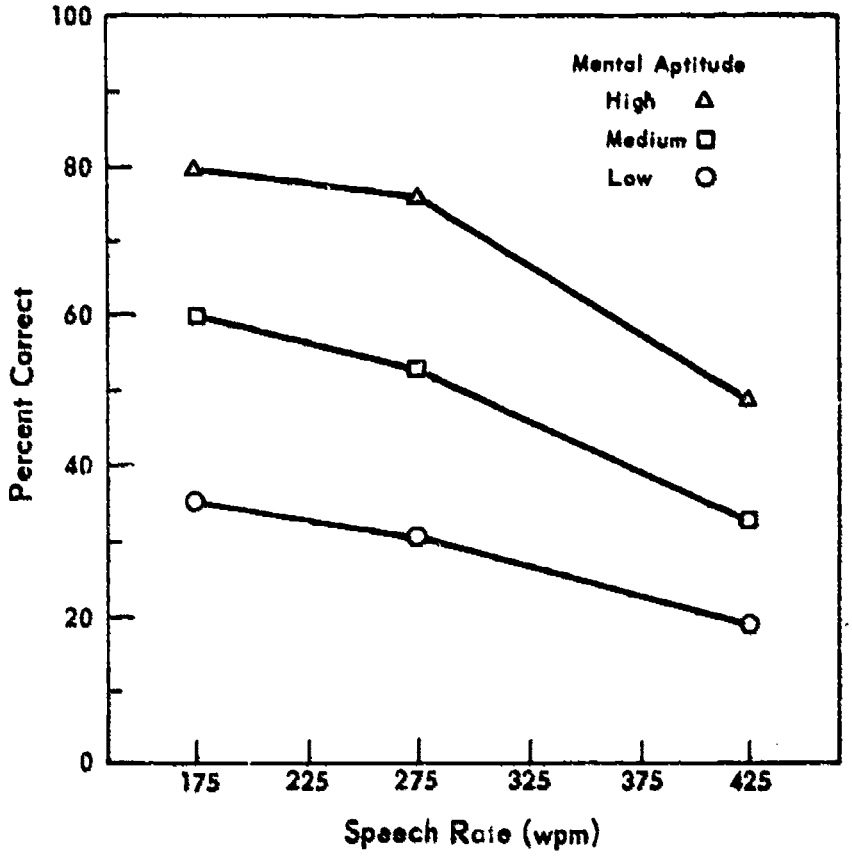


Figure 16 gives the results of research in which a time-compressed recorded message was given two times in the same amount of time needed to give the uncompressed message once. The ordinate shows the percentage correct on a listening comprehension test. The lower abscissa shows the time-compression ratios used, while the upper abscissa shows the resultant speech rates in words per minute. In each instance, the upper

Figure 15

Comprehension Scores for the Three Aptitude Groups As a Function of Message Presentation Rate



numerals in the paired values on the scales indicated the compressed version presented first.

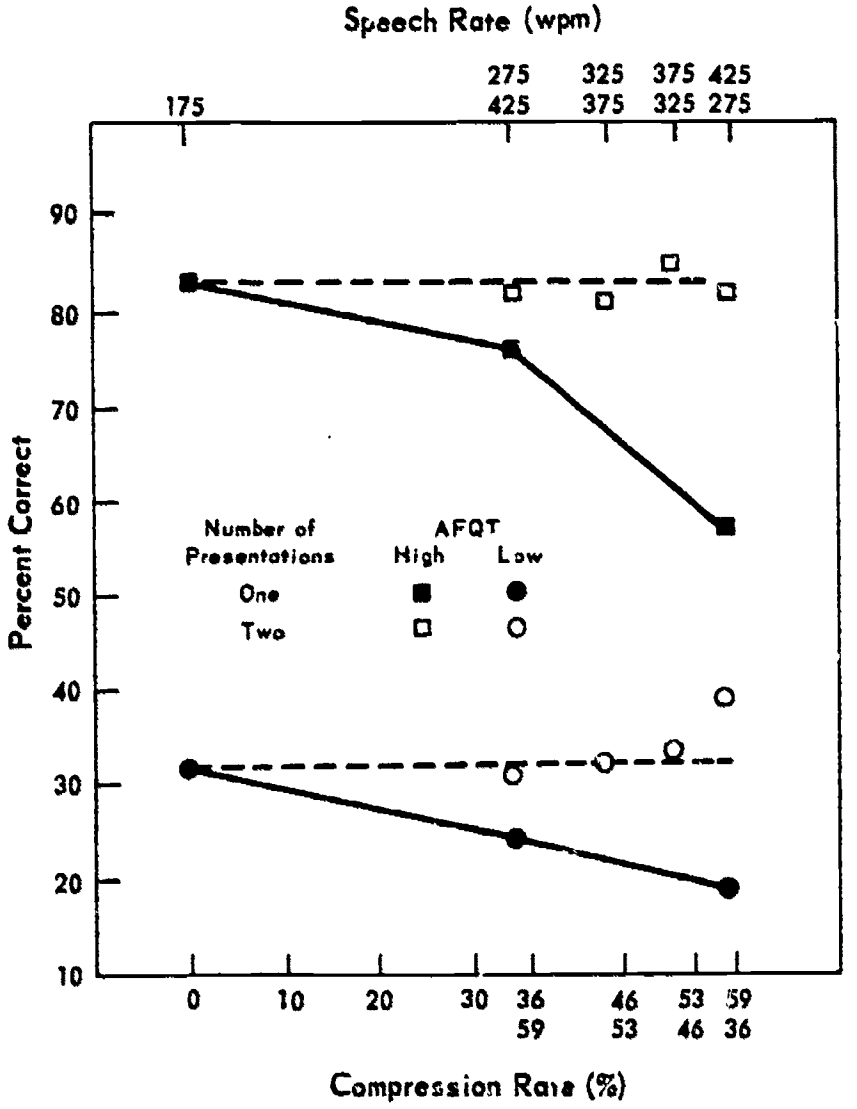
The open symbols show the results on listening comprehension of presenting the message twice. The filled symbols give results of listening one time to the message presented at the speech rate (compression ratio) indicated by the upper numeral on the abscissa at that point.

As indicated, while presenting the message twice in compressed form did improve comprehension over that obtained with a single presentation in compressed form, in no case was the double presentation more effective than a single presentation of the message in uncompressed form. Similar results have been reported by others (5, 6, 7, 8, 9, 10).

In a second attempt to improve peak learning in a given unit of time, additional, *new* information was presented in the time saved by the

Figure 16

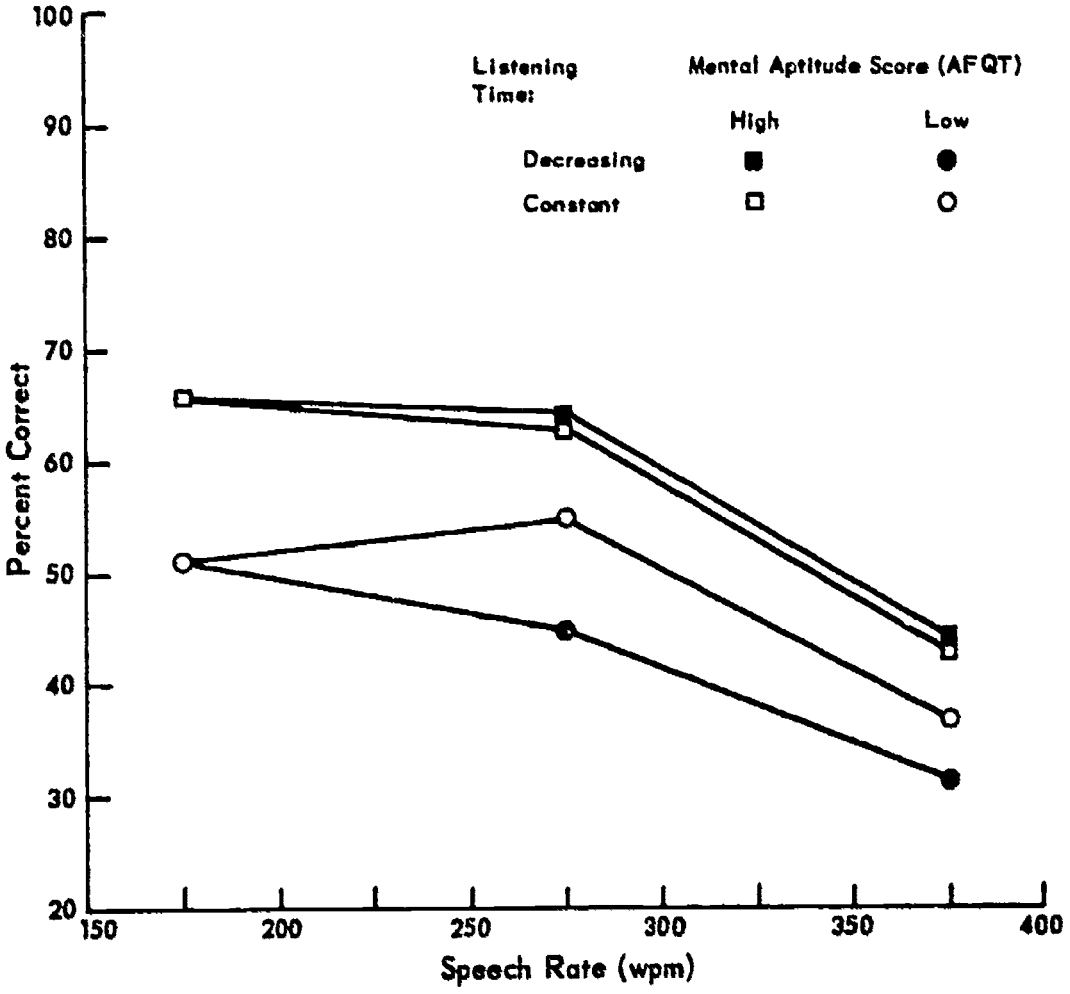
Comprehension Scores for High and Low Aptitude Men for One and Two Compressed Presentations of a Listening Selection



compression process. In this case five different conditions were presented to high and low aptitude men (Figure 17). In one condition, a message was presented at 178 wpm. In two conditions the message was given in compressed speech form at rates of 278 and 378 wpm. These speech rates resulted in reduction in the time required for listening to the message. In two additional conditions, the original message was compressed. But in these conditions, additional, *new* compressed material was added to maintain the total listening time equal to that for the uncompressed message. These conditions are represented in Figure 17.

Figure 17

Listening Comprehension Scores for High and Low Aptitude Men Listening to Time Compressed—Time Limited, or Time Compressed Time Extended Selections



In all conditions, subjects were administered a comprehension test over all the information presented at the rate of 378 wpm when the listening time was held constant to equal that of the uncompressed message. As indicated in Figure 17, presenting the new information relevant to the comprehension test in the time saved by the time compression of speech, did not improve peak learning over that obtained by listening to less information relevant to the test, but presented in uncompressed form. This was so for both high and low aptitude subjects, and for material presented at 278 and 378 wpm.

SUMMARY ON SUBSTITUTING LISTENING FOR READING

The work done on the feasibility of substituting listening for reading as a means of reducing the literacy demands of jobs has been exploratory and quite basic in regard to rate-controlled recordings. So far, this research indicates that men all along the continuum of aptitude can learn certain verbal prose equally well by listening and by reading. The work using rate-controlled recordings suggests that, in some cases, both high and low aptitude men can learn less difficult materials at rates of speech more than four sigmas above the mean rate of 175 wpm with only moderate losses in comprehension. While this may result in as much as 36% savings in listening time, how the time saved can be used to increase the general level of learning has yet to be demonstrated.

Design of Job Performance Aids to Reduce Literacy Demands of Jobs[1]

A job performance aid is any information storage device, such as a manual, checklist, or diagram, which is available to assist a man in doing his job. The present discussion will deal primarily with technical manuals as job aids, and will focus on the design of such manuals to make them more effective. There is considerable evidence (11, 12, 13) to indicate that properly designed job manuals can enable the less experienced and less literate man to achieve acceptable job performance, with fewer errors and little or no loss in time, and with much less training than has been thought necessary. This has been demonstrated for highly technical jobs in which complex machines and electronics systems are involved.

The major principle underlying the success of well designed aids is that job-related information, which is usually stored in a man's head, is stored in the aid *in such a way as to maximize the retrievability of the information*. Thus, the long training or on-the-job experiences that are usually needed for a man to acquire the necessary job information are reduced to the time spent in learning to use the job aids.

It must be underscored, however, that it is not the mere storage of information in the job performance aid rather than in the man's head which accounts for the effectiveness of the aid. Rather, it is the nature and manner of storage that is of crucial importance. For instance, a technical manual may contain needed information, but this information may be stored in such a way that the user is not able to work with it. Relevant data reported in Chapter 3 showed that most of the technical manuals in the mechanic and supply clerk jobs were written at a level well above the reading ability of the men in the job, and that there was a

[1] The assistance of PFC Donald Enderby in the work on Job Performance Aids is acknowledged.

correspondingly low level of usage of the materials. In addition to the reading difficulty level, other factors such as format, and nature and sequencing of information, may reduce the effectiveness of a job manual.

The key to the success or failure of a job manual or other aid is its design, which includes the nature and manner of presentation of the information in the aid. The foundation for the effective design of such materials is stimulus-response learning theory as applied to jobs by human factors scientists. In applying the stimulus-response theory to job aid design, the job is viewed as being composed of a set of tasks in which the worker makes some appropriate responses to a stimulus which cues (calls for) that response. By performing a task analysis, the various cuing stimuli and their associated responses are identified. Decisions can then focus on determining which cuing stimuli are to be placed in the job aid, and how they will be displayed.

The procedures for the production of job performance aids have been reviewed in detail (14), including analysis of man-machine systems, task description and analysis, allocation of functions to the job aid, determination of design features of aids, and production of the aids. I will describe one project for which technical manuals were redesigned to improve performance. Included in the description will be a comparison of the standard and redesigned manuals, and a summary of some of the production principles that HumRRO personnel and others have developed for producing pictorial job manuals.

SOME GUIDELINES FOR DEVELOPING JOB AIDS

In the late fifties, HumRRO developed training procedures for improving the performance of the tank crew in combat. Three job manuals were produced in the form of picture guides for tank drivers, loaders, and gunners. The procedure used in developing these guides involved the determination of what each member of a tank crew needs to know in order to do his job. To this end, training literature and crew activities were studied, and experienced officers were consulted. Lists of job requirements, covering the duties and skills of the three crew positions were established (15).

From the job task lists, job manuals, in the form of picture guides, were developed to cover the skills required of a given crew member. In developing the guides, an attempt was made to make most statements in behavioral terms (e.g., "unscrew the turret lock"), and to use simple terms. Then most of the tasks covered in the guides were given field tryouts and revised until it was found that even low aptitude trainees could profitably use the guides.

Figure 18 shows a page from the picture guide developed for tank gunners. It has small task steps, clearly identified by numbers in large type. Each step contains action verbs indicating the type of behavior the crewman is to perform. In the manual, the articulated pictures and verbal context provide a step-by-step procedure on the same page.

The HumRRO manual can be contrasted with a standard technical manual (excerpts shown also in Figure 18) which provides instructions for the same task—giving the quadrant the end-for-end test. The standard manual also presents step-by-step procedures for the end-for-end test; however, these procedures are provided in the context of other procedures on the same page, and there are no helpful illustrations. The only relevant information in picture form occurs more than 200 pages before the instructions for the end-for-end test. It provides only an orienting full-view of the gunner's quadrant; there are no pictures for guiding the behavior of the user.

Additional research and development has led to several guidelines[1] for designing training or job performance manuals in the form of pictorial aids. The most important guideline is to *test the job or training aid on the prospective user.* Revisions should be made until a novice can use the aid to guide his performance without error or assistance, and with little hesitation. Additional guidelines for design of manuals (16, 17, 18, 19, and a memorandum[2]) are:

(1) Conciseness: The information provided in the job manual should require a minimum of coding, decoding, and manipulation of information. Hence the simplest possible vocabularies and sentence constructions should be used. Irrelevant information, background material, and "nice to know" information should not be interspersed with directions designed to guide the actions required in the task performance.

(2) Standardization: The presentation and organization of information should be standardized across and within each class of tasks. In this respect, specific guidelines may be developed to control syntax (sentence structure), use of classes of verbs and nouns, and so on. This reduces the need for creative writing on the part of the aid designer, and insures high redundancy levels for the user.

(3) Analysis of Complex Tasks Into Sub-Tasks: At times, to keep a performance sequence simple, small portions of a complex task will have to be presented as a sub-task.

[1] A consulting report on pictorial methods of instruction for the M-73 machine-gun and the .45 cal. automatic pistol, by J. Roger Ware, Elmo E. Miller, and James L. Constantinides, December 1968.

[2] A memorandum by HumRRO Division No. 2, Fort Knox, Kentucky, August 1967, giving guidelines for the design of technical manuals to be used in training.

3-27A) and rotate knob until micrometer and azimuth pointers are at zero.

f. Traverse the turret manually through a complete circle until periscope M31 or M32 reticle aiming cross is laid on the original aiming point.

g. Assure azimuth indicator micrometer and azimuth pointers are at zero. If both pointers are not at zero, notify organizational maintenance personnel.

3-267. Azimuth Indicator M20C-1 or M20E2 Slippage Test. To check for slippage of the azimuth indicator, proceed as follows:

a. Perform steps a and b of paragraph 3-266.

b. Traverse the turret rapidly in power and stop suddenly; repeat this operation two or more times in the same direction. Turn off turret power.

c. Manually traverse the turret in the opposite direction until the periscope M31 or M32 reticle aiming cross is laid on the original aiming point.

d. Assure azimuth indicator micrometer and azimuth pointers are at zero. If both pointers are not at zero, notify organizational maintenance personnel.

e. If both pointers indicate zero, repeat steps b through d, in opposite direction.

3-268. Ballistic Computer M13A1D or M13A2 Test. To test the ballistic computer, proceed as follows:

a. With the range correction knob of the ballistic computer (figure 2-25) at zero, rotate the range knob on range finder (figure 2-27) and determine whether the inner (range) pointer indicates the same range on the computer range dial that is indexed on the range scale of the range finder. Make this check for various ranges.

b. Index a range of 1,800, 1,200, or 2,000 meters on the range scale of the range finder.

c. Index a type of ammunition in the computer as shown in procedure 7 of figure 2-55.

d. Turn the computer on as shown in figure 2-55 and determine whether the superelevation output shaft and superelevation actuator shaft rotate.

e. Determine whether the outer (superelevation) pointer moves to match the inner (range) pointer.

f. Determine whether the correct superelevation for the range and ammunition selected is indicated on the superelevation mil counter. (Use firing tables.)

3-269. Fire Control (Elevation) Quadrant M13A1 (M46) or M13A3 (M60A1) Adjustment. To adjust the fire control (elevation) quadrant, proceed as follows:

a. Level the 105-mm gun using a corrected gunner's quadrant M1A1 (figure 2-41).

b. Without disturbing the lay of the 105-mm gun, center the bubble in the level vial of the fire control quadrant (figure 2-39) by rotating the elevation knob.

c. Check the elevation scale. If zero is not indexed on this scale, loosen the screw at each end of the scale and slip it until zero is opposite the elevation scale index. Tighten the screws.

d. Check the micrometer scale. If zero is not indexed, loosen the three screws on the elevation knob, then slip the micrometer scale. Check the bubble to be sure it is still centered in the level vial; if it is, tighten the three screws on the elevation knob, and the instrument is ready for use. If the bubble is not centered, repeat the adjustment procedure.

3-270. Gunner's Quadrant M1A1. To test the zero setting (end-for-end test) of the gunner's quadrant, proceed as follows:

a. Set both the index arm and the micrometer scale at zero.

b. Place the quadrant on the quadrant seats of the breech ring with the black "Line of Fire" arrow pointed toward the muzzle. Center the bubble by elevating or depressing the gun.

c. Turn the quadrant end-for-end. If the bubble recenters itself, the quadrant is in perfect adjustment. If the bubble does not recenter itself, try to center the bubble by turning the micrometer knob.

d. If the bubble recenters, the correction is plus (positive) and equal to one-half the micrometer reading. Set this adjusted reading on the micrometer scale; center bubble by elevating the gun, verify correction by turning

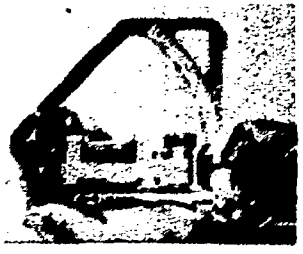
CHECKING THE GUNNER'S QUADRANT FOR ACCURACY

Giving the quadrant the end-for-end test.

1 Looking at the quadrant from the side which reads LINE OF FIRE, turn the micrometer knob to line up the mark on the index arm with the mark on the index plunger.

2 Set the micrometer scale at zero by lining up the mark below the micrometer knob with 0.

3 Push the index plunger toward the index arm to free the plunger from the teeth of the elevation scale; then move the index arm until the top of the plunger is lined up with the zero mark on the elevation scale.



(4) Sequencing of Information: The organization of content within any type of task should be based on analysis of the nature and sequence of task elements involved. For instance, procedural instructions should be presented in the sequence in which they are performed. This applies to pictures, paragraphs, sentences, and phrases within the sentences.

(5) Completeness: Each significant point in a task action sequence should be presented. This requires careful task analysis and thorough development by user testing. Content of the job aid manual should be accurate and kept up-to-date, and provisions should be made for modifying the manual as new requirements arise.

These are general design considerations that may enter into the production of any job-aid manual. Where extensive use of photographs or other pictures is to occur, there are several additional recommendations:

(1) Page layout: Ideally, a sequence of photographs, or drawings, illustrating one step, or element, in a task (such as setting the micrometer scale in Figure 18) should be presented on one page or opposing pages so the user can see all of that step without turning pages.

(2) Relating pictures to words: Figures, photographs, and drawings should be closely correlated, in proximity and relevance, to the text material.

(3) Subjective viewpoint: Photographs and figures should be taken from the user's point of regard.

(4) Consistency of camera angle: Do not change the camera angle (user's point of view) unless critical cues can be seen only from another angle. In such cases, indicate graphically the changes of view.

(5) View "before" the action: Photographs or drawings should show the present state of the system rather than its state after a response is made. The system status "after" the action should be represented by animation devices, such as arrows or dotted lines, corresponding to the operator's mental image of the desired change.

(6) Avoid two pictures for one movement: In presenting a single movement, do not use two separate photographs or drawings to represent the system "before" and "after." This requires the user (especially the novice) to make an extremely difficult discrimination between pictures, even when the difference seems apparent to an experienced person.

(7) Critical cues: Direct attention to critical cues by relevant animation such as arrows, color coding, outlining, and so forth.

As these guidelines indicate, the development of an effective job-aid is not a simple, "quickie" process. However, in the interim between the decision to develop adequate job aids and their actual delivery, a supervisor or manager may take several steps to make existing aids more usable. Some suggested measures are: (a) provide indexes to existing manuals in terms of local jargon; (b) excerpt (photocopy, etc.) certain frequently-used segments of manuals; (c) rewrite parts of present aids in local jargon and

in simple language suitable to even the poorest readers; and (d) encourage and provide on-the-job training in the location and use of existing manuals and other job aids where available.

The fact that it is possible to design materials to permit marginally literate men to perform jobs satisfactorily indicates that it is feasible to hire the less literate man and to utilize him effectively, while providing literacy training to up-grade there skills. By this means, it should be possible to employ the marginally literate in responsible, growth-oriented jobs, while maintaining the efficiency and effectiveness of the job sub-system.

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Chapter 8

Functional Literacy Training: A Case Study

Literacy research and development projects conducted by HumRRO for the Army have had two major objectives: first, to determine the nature of the literacy problem in the Army by studying the literacy demands of Army jobs and the literacy skills of Army personnel, and second, to develop a literacy training program to provide job-related, functional literacy skills.

DEFINING THE LITERACY PROBLEM

Literacy Demands of Army Jobs

In these projects, we studied the literacy demands of Army jobs by a variety of methods. In one, we developed a special formula that permits an estimation of the reading grade level of ability needed to read and comprehend Army job manuals (Chapter 2). This "readability" formula was applied to samples of reading materials from seven jobs into which larger numbers of marginally literate men might be assigned.

The average reading difficulty level of these materials is shown in Figure 19. Also shown are the average reading ability levels of three groups of Army personnel: Army Preparatory Training (APT)[1] graduates for FYs 1968, 1969, and 1970; and mental Category IV and non-Category IV job incumbents.[2] The figure shows considerable disparity between the reading ability of personnel, and the readability levels of job printed materials, which range from 10+ to 12th grade.

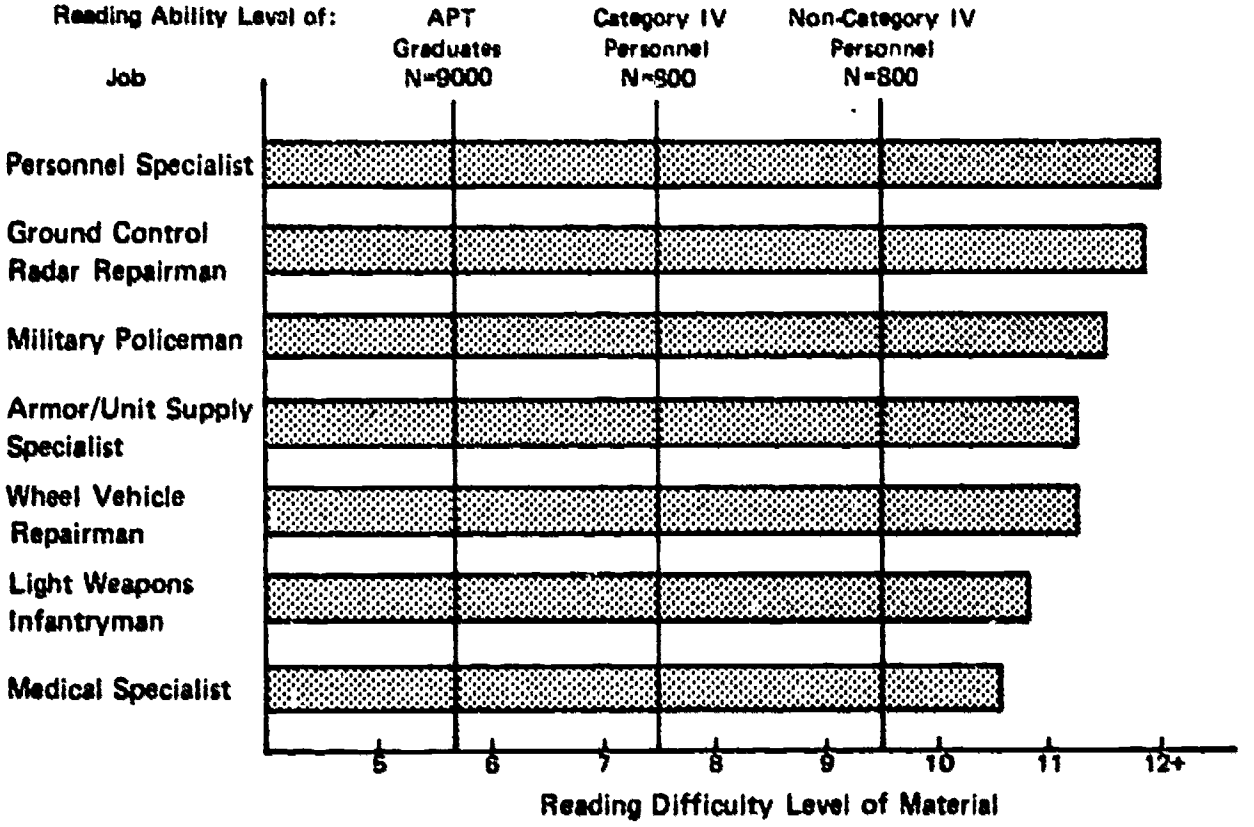
Based on *HumRRO's Literacy Research for the U.S. Army: Developing Functional Literacy Training*, Professional Paper 13-73, by Thomas G. Sticht, John S. Caylor, Lynn C. Fox, Robert N. Hauke, James H. James, Steven S. Snyder, and Richard P. Kern, December 1973.

[1] Army Preparatory Training, APT, is the name of the Army's remedial literacy training program.

[2] Mental Category IV personnel are persons who score below the 30th percentile on the Armed Forces Qualification Test (AFQT; see page 74). Non-Category IV personnel score at or above the 30th percentile on the AFQT.

Figure 19

Average Reading Difficulty Level of Materials in Seven Jobs



The readability technique offers a low-cost method for estimating the reading demands of job materials. However, it does not provide a direct indication of how well people can read and comprehend job materials; for this information we need to test people on samples of job reading materials.

As a first step, structured interviews were conducted with men of different reading ability levels who were working as mechanics, supply clerks, and cooks. The interview was conducted at the man's job location and he was asked to provide the following:

(1) Personal data (Name, Unit, etc.).
(2) A description of his typical work day.
(3) Five examples of his use of information sources other than printed materials.
(4) Five examples of his use of printed materials (obtain the materials and locate the exact page referred to).
(5) Five examples of duties or tasks performed not involving use of printed materials.

(6) Five examples of the use of arithmetic.

(7) Ways to modify printed materials to make them easier to use.

Figure 6 (Chapter 3) shows the extent to which men of differing reading levels reported the use of job materials. Since each man could give, at the most, five citations of the use of reading materials, five citations is 100% of the maximum possible; four citations would be 80% of the maximum possible, and so forth. As shown in the figure, for Supply Clerks and Mechanics, the higher the reading level the greater the reported use of job reading materials. For Cooks, there was a high reported usage of materials, mostly recipe cards. In general, however, the importance of these data is that they suggest that men who have higher literacy skills will use job reading materials more frequently.

The main purpose of the structured interview was to obtain samples of job reading materials actually used by job incumbents. With the materials in hand, we constructed reading tests using photocopied samples of actual job reading material (Chapter 3), and asked questions to determine how well people could locate and extract information from the job reading materials. We administered the Job Reading Task Tests (JRTT) for Mechanic's, Supply Clerk's, and Cook's reading material to several hundred men at the Fort Ord reception station. We also administered a standardized reading test, so we could see how performance on the JRTT varied as a function of general reading ability.

Data for men tested on the Cook's, Repairman's, and Supply Clerk's job reading task tests are shown in Figure 8 (Chapter 3), which gives the percentage of men at each reading grade level who achieved either 50, 60, or 70% correct on the JRTT. Thus, for the Repairman's test, some 70% of the men who read at the eighth grade level achieved 70% correct. For Supply Specialists, only 20% of the men reading at the eighth grade level scored 70% correct or better on the Supply Clerk's JRTT. These curves clearly show that the Cook's job reading materials are easier than the Repairman's, which, in turn, are easier than the Supply Clerk's materials.

If management wanted literacy training to provide reading training up to the point where 70% of the men could get 70% correct on the JRTT (the 70/70 criterion typically used in the Army and other services), the minimal literacy level for the Cook's field would be 7 to 8, for Repairmen it would be 8, and for the Supply Clerks it would be 12.0! This clearly exceeds the current APT goal of 5.0. Even the generous objective of 70/50 would suggest a minimum targeted level of 6.0.

As a final approach to the problem of defining literacy demands of Army jobs, we studied job incumbents in the Armor, Mechanic, Supply, and Cook's jobs and compared their performance on literacy tests and on three measures of job proficiency (Chapter 4). In this chapter, only data concerning the relationship of reading to job sample and job knowledge test performance will be considered.

For this research, 400 men were tested in each job. The job sample tests are 4- to 5-hour individually administered tests in which men performed actual job tasks. Figure 20 shows a Mechanic repairing a vehicle while the test administrator looks on. In Figure 21 a Cook is shown performing a job sample test, while Figure 22 shows an Armor Crewman responding to arm and hand signals in the Armor Crewman's job sample test. A Supply Clerk works in a simulated office performing a job sample test in Figure 23. As illustrated in the four figures, the job sample tests are actual hands-on job tasks.

The job knowledge tests were paper-and-pencil tests, constructed under the supervision of HumRRO research personnel in conjunction with Army content experts. The tests were designed to include questions about information actually needed to do the jobs.

The percentages of Cooks, Mechanics, and Supply Clerks at various reading grade levels who scored 50% or better on the job sample and job knowledge tests are shown in Figure 24. As with the job reading task tests, it is clear that reading ability is related to both of these measures of job proficiency, although, as expected, the relationship is strongest for the paper-and-pencil job knowledge test.

In the job sample data, the solid line is the average of three jobs. If we choose the not-too-exacting criterion of literacy at which 70% get 50% correct on the job sample test, the minimal literacy level would fall in the seventh grade. It would be much higher for job knowledge, somewhere in the vicinity of the 12th grade!

Another way to consider the job proficiency and reading ability data is to see how well men perform relative to others in their job. Figure 9 (Chapter 4) shows data for Armor Crewmen. Here we have divided all the Armor Crewmen who took the job sample and job knowledge tests into four groups: the top 25% of performers, the next 25%, the next to bottom 25%, and the bottom 25%. For each reading ability level, we have presented the percentage of men in each quartile of proficiency. At the bottom of the figure is the pattern—that is, the proportion of men in each quarter—that we would expect to find if reading ability was not related to job proficiency—there would be 25% of all who took the test in each quartile. Over- or under-representation in each quartile occurs when there is a correlation between reading and job proficiency.

Because of this correlation we see that, for the job knowledge data, 59% of the readers in the 4 to 5.9 grade level were among the bottom 25% of job performers. For the job sample data, 38% of the 4 to 5.9 grade level readers were in the bottom quarter of job performers.

A similar finding holds for all four jobs, as Figure 9 (Chapter 4) shows.

To illustrate how these data were used to establish the general minimal level of literacy for Army jobs, we will use the Cook's data

Figure 20

Repairman Test: Wheelbearing Adjustment Problem

Figure 21

Cook Test: Job Skill Demonstration

Figure 22

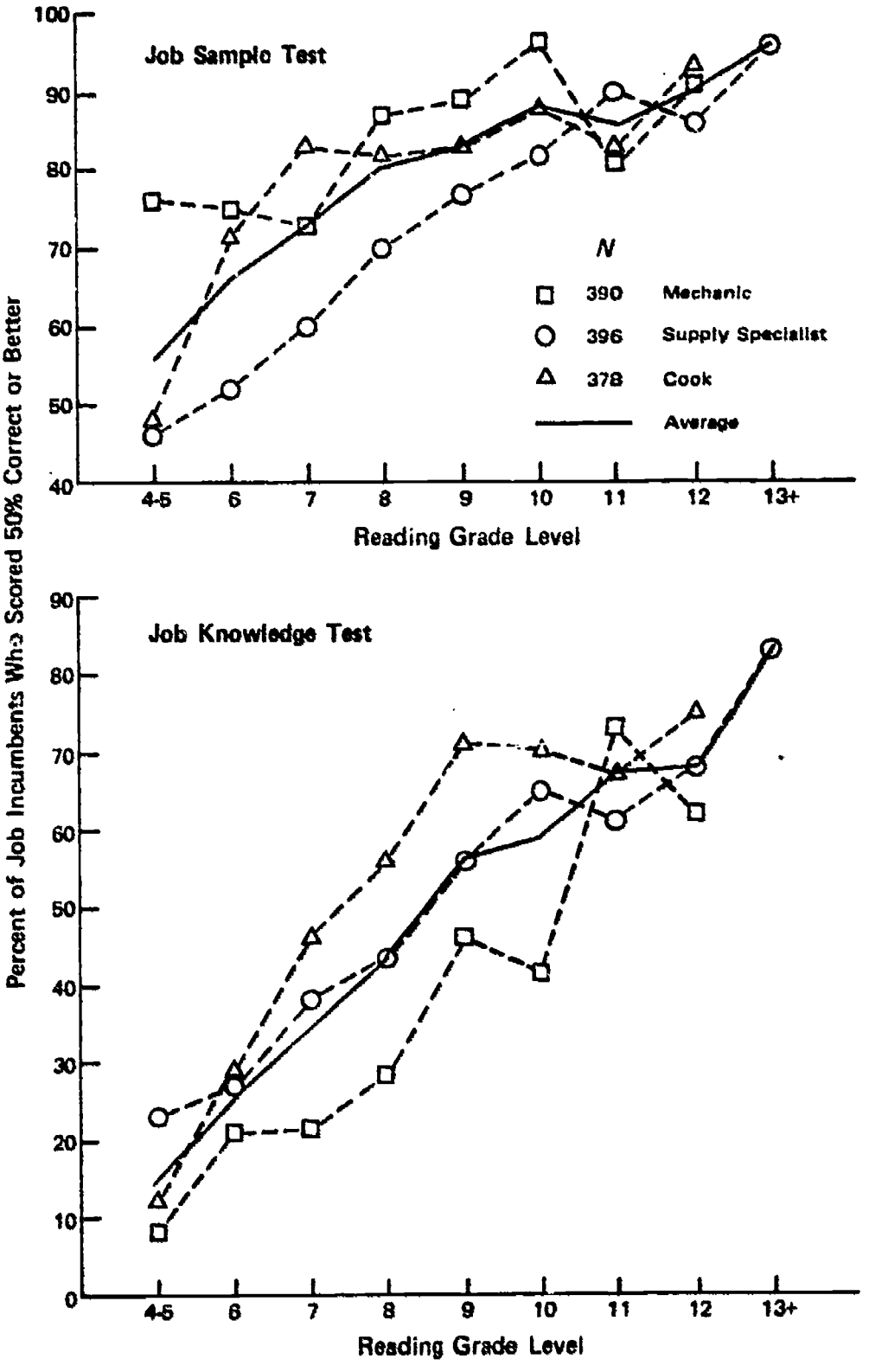
Armor Crewman Test: Arm and Hand Signals

Figure 23

Supply Specialist Test: Set-up for Problem

Figure 24

Reading Ability and Job Proficiency



(Figure 9). What we did was to choose a decision rule stating that the lowest level of literacy that should be used to establish goals for literacy training is the level at which men would not be expected to be over-represented in the bottom quartile of performers. Looking at the Cook's job knowledge data, we see that only at the 7-7.9 level does representation in the bottom quarter fall equal to or below the expected 25%. Similarly, for the job sample data, the 7-7.9 level is the one at which people are not over-represented in the bottom quarter of performers. Thus, for both types of data, a seventh grade level of reading proficiency seems desirable.

Similar analyses applied to the Armor Crewman and Mechanic data suggest minimal levels of 8.0, while the Supply Clerk's job would be best provided for by a literacy program targeted to ninth grade reading ability.

These analyses, coupled with the extensive data on job reading task test performance and on the readability of Army materials, suggest the conclusion that the *minimum* functional literacy level for the Army is seventh grade reading ability. Thus, remedial literacy training ought to be targeted to this level *as a minimum.*

Reading Ability of Army Personnel

Up to this point we have discussed research that has focused on the reading demands of Army jobs. The other side of the Army's literacy problem concerns the reading ability levels of the personnel available to do the jobs. We have obtained several estimates of the reading ability levels of Army personnel.

One set of data (Table 30) shows the reading ability levels of personnel just after Project 100,000 began. About 15% of the total Category IV sample were members of Project 100,000. As shown in the table, about 40% of the Mental Category IV personnel read below the 7.0 grade level, compared to only 8% of the non-Category IV men.

These data represent, to a large part, pre-Project 100,000 distributions of reading ability levels. Table 31 data were obtained at Fort Ord in September 1970 and September 1971 in conjunction with the development of Job Reading Task Tests (Chapter 3), while Project 100,000 was in full swing. The table shows the percentage of men in each Armed Forces Qualification Test (AFQT) decile who scored below the three reading grade levels. The last column indicates that as many as 12% of those with AFQTs of 40-49 may read below the seventh grade level, and that the proportion increases as AFQT decreases.

Finally, data on the reading levels of Army personnel were obtained in February and March 1972 when we monitored the reading testing of Category IV men at all Army APTs. During this period, the continued need for APT was reviewed after Project 100,000 was discontinued and entry requirements for Category IV men were raised. These data are for post-Project 100,000 personnel. Data from five APTs concerning the

Table 30

Reading Ability Levels for Army Job Holders, 1968-69

Reading Grade Level	Mental Category IV (N=762)		Non-Category IV (N=774)	
13+	0		7	
12-12.9	0		10	
11-11.9	0		7	
10-10.9	3		19	
9-9.9	12		23	
8-8.9	17		14	
7-7.9	28		12	
6-6.9	24	40	6	8
5-5.9	12		2	
4-4.9	4		0	
Total	100		100	

Table 31

AFQT and Reading Ability, 1970-71

(percent)

AFQT	Reading Grade Level (N=2,300)		
	5	6	7
90-99	0	0	0
80-89	0	1	3
70-79	0	0	0
60-69	2	8	12
50-59	2	2	2
40-49	5	8	12
30-39	3	10	22
20-29	9	24	37
10-19	6	26	53

numbers and percentages of Category IV men scoring at various reading grade levels are presented in Table 32. The last column shows the cumulative percentage of men, and indicates that 11% of men scored below the 5.0 level, the target level for the current APT program. Thirty-three percent fall below the 7.0 level recommended by HumRRO on the basis of the data reviewed earlier.

Table 32

Reading Levels of Category IV Men Screened for Army Preparatory Training (APT)[a]
(N = 1,625)

Reading Grade	Number	Percent	Cumulative Percent
2.0-2.9	6	0	0
3.0-3.4	14	1	1
3.5-3.9	28	2	3
4.0-4.4	39	2	5
4.5-4.9	91	6	11
5.0-5.4	89	5	16
5.5-5.9	97	6	22
6.0-6.4	114	7	29
6.5-6.9	71	4	33
7.0-7.9	288	18	51
8.0-8.9	242	15	66
9.0-9.9	191	12	78
10.0-10.9	147	9	87
11.0-11.9	141	9	96
12.0-12.6	67	4	100

[a]Test Period, Feb-Mar 1972; Forts Ord, Jackson, Leonard Wood, Dix, and Knox.

From these data, we can make estimates of the continued need for remedial literacy training in the Army. If the current APT target of 5.0 is maintained, 11% of Category IV personnel fall below this level. Rounding a little, we can say that some 10% of Category IV men will qualify for APT. Since, by DoD quota directives, Category IV men can be expected to make up at least 20% of the Army's input, some 10% of 20% of all recruits will qualify for APT. If the Army input in a year is 100,000 men, 20,000 will be Category IV men, of whom 2,000 will qualify for APT under present standards.

If the standards are raised to 7.0, then 33% of the new, higher quality Category IV men, or roughly 6,500 men per year (based upon 100,000 input), are predicted to qualify for remedial literacy training.

Summary of HumRRO's Work on Defining the Literacy Problem

To briefly summarize what we have learned about the Army's literacy problem: We have seen that (a) by a variety of methods, the reading demands of Army jobs, even the less complex ones, far exceed the reading ability levels of many personnel; (b) there is a positive relation between reading ability and job proficiency; (c) the present goal of Army remedial literacy training falls considerably short of the reading demands of the jobs; and (d) even with higher mental aptitude enlistment standards, there is a need for remedial literacy training, whether the objective is fifth grade ability or the more realistic minimal objective of seventh grade ability. This need is likely to increase as the Army becomes an all-volunteer force.

DEVELOPING JOB-RELATED, FUNCTIONAL LITERACY TRAINING

Work Unit FLIT: Objectives and Procedures

HumRRO Work Unit FLIT (*F*unctional *LIT*eracy) was initiated in September 1971 to develop a prototype literacy training program for the Army that will provide a level of functional literacy appropriate to present *minimal* job reading requirements. The program developmental effort operates under two major constraints: The program is not to exceed the present APT duration of six weeks, and it is not to lower current APT standards (i.e., grade 5.0 achievement). Within these constraints, the FLIT development effort is concerned with the total set of components in an instructional system, including selection of students and instructional staff, development of instructional curriculum, materials, and methods, and program evaluation.

In planning for the FLIT experimental program, visits were made to APTs at Forts Dix, Jackson, Polk, Lewis, and Ord, as well as the Air Force literacy school and the large Job Corps center at San Marcos, Texas, in order to locate exemplary practices for possible inclusion in the FLIT program. Site visits to the APT schools showed that a wide variety of programs were in effect, but nothing of an exemplary nature. Both civilian and military personnel were found as instructors; administrators were always civilian; and there were no consistently applied criteria for selecting instructors—most had college degrees, but many had had no experience in adult basic education. In some cases, school administrators had no training either in reading or in education administration.

Materials differed from one APT to another, and ranged from an almost totally programmed, mechanized, expensive system especially designed for young adults to a heavy reliance on the "Private Pete" series developed in World War II, reinforced by some more current workbooks from United States Armed Forces Institute (USAFI). Information about the success rates of the APT schools for FY 1970 and 71 was obtained. Table 33 shows the number of men processed through each of eight APTs and the percentage of men who achieved the 5.0 level or above, in either Week 1, Week 3, or Week 6, the final week of APT.

Table 33

Achievement Data for Army APT, FY 1970 and 1971

APT	Percent Who Achieved 5.0 Level				Percent Below 5.0	Percent Administrative Drop	N
	Total	Week					
		1	3	6			
Fort Polk	86	8	66	13	10	4	1,917
Fort Campbell	86	2	73	12	10	4	2,333
Fort Knox	83	70	9	4	12	5	3,068
Fort Dix	78	29	28	21	13	10	2,514
Fort Jackson	75	20	40	16	20	4	2,006
Fort Lewis	73	10	41	23	19	8	1,168
Fort Ord	70	0	49	22	18	12	1,062
Fort Leonard Wood	70	16	46	8	19	11	468
Overall	80	26	40	15	14	6	17,035

The percentage of men who achieved 5.0 in the first week varies from none at Fort Ord to 70% at Fort Knox, with the overall average for the Army at about 25%. The variation among APTs reflects the fact that testing in Week 1 of APT is not mandatory in Army directives; rather, teachers are permitted to recommend for retesting those whom they feel are qualified in the first week. Data obtained from the Fort Ord APT during special testing conducted during Week 1 indicated that about 50% of the people qualified for graduation within two days of their arrival at APT. A basic conclusion from these data is that much of APT success can be attributed to testing artifacts, not the least of which is the hectic pace of the reception station testing.

Additional activities during the planning phase of FLIT involved the collection of data from the APT school at Fort Ord and the Air Force

literacy program. The data provide a standard to which the FLIT achievement data may be compared relative to other military programs.

As a consequence of our visits to the APT schools and a survey of literature on the ineffectiveness of previous Army, Navy, and Air Force attempts at literacy training, we concluded that (a) past achievement data reflect large amounts of testing artifacts, (b) the fifth grade reading level is inadequate for Army career fields, and (c) if a literacy training program of six weeks' duration is to have any direct effect on a man's subsequent job performance—either in job training or on the job—the literacy training should deal directly with the kinds of reading tasks the students encounter in AIT and on the job.

With these considerations in mind, we have developed a literacy program that differs considerably from the current APT program. Both APT and FLIT are six weeks in duration—beyond this there is not much similarity.[1] The objective of APT is grade level 5.0 in general reading, while the objective of FLIT is to provide students with the ability to use their job reading materials with the competency of a person having at least 7.0 general reading ability. However, as the data presented earlier show, the Mechanic could use training up to a minimum of 8.0, while the Supply Clerk's job requirements are higher at 9.0. Thus, while the FLIT program tries to reach these higher levels, we know that there is a limit to what can be accomplished, therefore our official minimum goal is the 7.0 level in job reading.

The curriculum under the APT program is a General Education Development (GED), program consisting of six hours daily of reading, writing, English grammar, arithmetic, and social studies. In planning the FLIT program, we took note of the fact that all previous attempts to improve job proficiency through very brief periods of GED training have failed and also that the GED curriculum has little direct bearing on job reading tasks. For this reason, the FLIT program uses the six weeks available to train men explicitly in reading and extracting information from job reading materials. Although we also include a general reading program, which provides literature and practical information about consumerism, citizenship duties, and other information relevant to life management, our primary emphasis is upon job-related reading. Much behavioral science research has indicated that learning is more likely to transfer from the school to the job situation when the school tasks closely resemble the job tasks.

In order to focus reading training directly on a student's job reading materials, we must know what his job is going to be. Since this

[1] Actually, FLIT is only 26 days rather than 30 days, because we must test men on Tuesday of the last week to get orders by the end of the week, and to let men out-process.

information isn't available until several weeks into Basic Combat Training (BCT), we have scheduled the FLIT program *after* BCT. Our survey of the reading demands of BCT showed very little need for reading, especially under the new performance-oriented program.

Thus, by placing the FLIT program after BCT, the reading training can be focused directly on a man's job reading materials. Also, time and money are saved by not providing literacy training to men who cannot complete BCT. Of 185 men who qualified for FLIT at the reception station testing, 24 (13%) were discharged during BCT. Thus, the post-BCT location for FLIT training effects some immediate cost savings for literacy training.

The FLIT Instructional Program

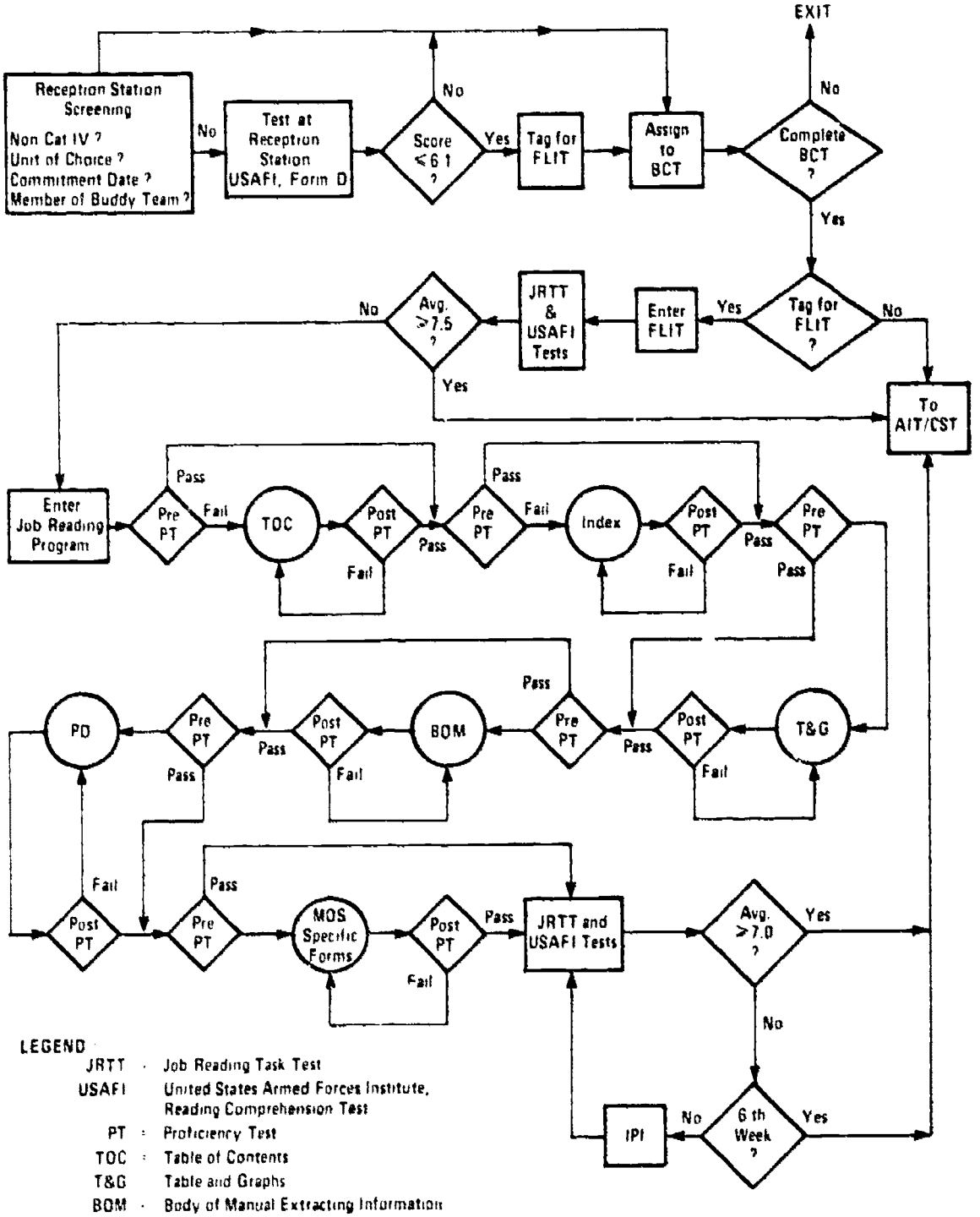
An overview of the FLIT instructional program in job reading as of December 1973 is presented in Figure 25. This figure shows the flow of students through the FLIT job reading program. First, men are tested at the reception station using the present APT screening test, the USAFI Intermediate Achievement Test, Form D. Since we are aiming at 7.0 proficiency, we have raised the entry cutoff score from 4.9, the current APT cutoff score, to 6.1, which is .9 of a grade unit difference below the target goal of 7.0. This difference has been introduced to try to reduce the numbers of people who might erroneously be sent to FLIT, because of testing artifacts of the kind mentioned earlier (i.e., some 50 to 70% of present APT success might result from testing artifacts). Present APT accepts people reading at 4.9 and sends them out at 5.0. As we will show later, testing artifacts may produce as much as .9 of a year's gain, so we have introduced this difference between selection and target grade levels.

If a man scores higher than 6.1, he goes directly to BCT; if he scores below 6.1, he is tagged for FLIT and then sent to BCT. If a man fails to complete BCT, he is no longer in the program. If he completes BCT and is not tagged for FLIT, he goes directly to job training; if tagged for FLIT, he is sent to the school and on the day of entry is administered the Job Reading Task Test and the USAFI. If he performs well on both of these tests—about 7.5 averaged over the two tests—we initiate action to move him along to job training. If he does not do well, he is entered in the job reading program.

In the job reading program, he enters Module 1, which provides practice in using tables of content from manuals in his job. When he first enters the TOC module, he takes a proficiency test. If he passes the PT, he skips the TOC module and goes on to the module on Indexes and follows a similar procedure. Whenever a man fails a PT, he must complete the work of the module and take a post-module PT. If he passes the post-PT with 90% correct in less than 20 minutes, he proceeds to the next module. If he fails either the accuracy or the time criteria, he is recycled

Figure 25

FLIT Job Reading Program, Strand 1, as of December 1, 1973



LEGEND

JRTT	-	Job Reading Task Test
USAFI		United States Armed Forces Institute, Reading Comprehension Test
PT	-	Proficiency Test
TOC	-	Table of Contents
T&G		Table and Graphs
BOM	-	Body of Manual Extracting Information
PD	-	Procedural Directions
IPI	-	Individually Prescribed Instruction

through additional work in the module until he masters the content. If he does not master the content in three trials, he is passed on to the next module. Because the modules are not learning hierarchies, we have decided that it is better to provide the student with experience in all of the modules, rather than insisting upon a rigorous adherence to mastery criteria for each module.

At the end of this sequence, the man is retested on an alternate form of the JRTT and USAFI tests. If he passes both, or averages above the 7.0 level, he is released from FLIT with orders to job training. If he fails the end of program tests and is in the sixth week, he is sent along to job training. If he is not in the sixth week, his JRTT test scores are examined to see where he needs more training and an individually prescribed instructional sequence is made up for him. He continues this cycle until he passes the tests or six weeks are up, and is then sent along to AIT/CST.

The job reading program just described is currently in use with materials for six career clusters: Combat, Medic, Cook, Communication, Clerical, and Mechanical. The job reading materials for the Combat, Medic, Cook, and Communication clusters are shown in Table 34, while Table 35

Table 34

Job Reading Materials for Combat, Medic, Cook, and Communication Clusters

Combat	Medic	Cook	Communication
FM 7-11	FM 8-10	TM 10-405	TM 11-5805-201-12
FM 22-5	FM 8-35	TM 10-415	TM 11-381
FM 23-8	FM 8-50	TM 10-419	TM 11-2134
FM 23-11	TM 8-230	AR 30-1	TM 11-5805-262-12
FM 23-12		TM 10-412	TM 11-5820-401-10
FM 23-16			TM 11-5820-520-12
FM 23-67			FM 24-20
FM 23-90			TM 11-381
FM 9-1005-224-10			TM 11-5820-398-12
FM 9-1345-200			
FM 21-6			
FM 5-20			
FM 23-71			
FM 23-9			

Table 35

Job Reading Materials for Clerical and Mechanical Clusters

Clerical	Mechanical	DA Forms
AR 725-50	TM 9-2320-218-20	2765
AR 210-130	TM 21-305	2402
AR 735-11	TM 9-2320-209-10	2408
AR 700-84	TM 9-8000	2408-1
AR 710-2	TM 9-2320-209-20	2400
AR 710-1	TM 9-2320-218-10	2408-7
AR 735-5	TM 9-8024	2408-8
CTA 50-901	TM 9-243	2404
TM 38-750	TM 9-2320-244-20	2765-1
DA PAM 310-1	TM 21-300	2407
DA PAM 310-7	TM 38-750	DA-1
AR 680-1	FM 20-22	173
DA PAM 310-2		3034
FM 21-6		3327
		314
		2062
		201
		2867

shows the materials for the Clerical and Mechanical clusters, as well as the various DA forms that are taught.

The series of photographs (Figures 26 through 40) illustrate the FLIT Job Reading Program flowchart presented in Figure 25. The photographs show the progress of a man through the program, beginning with a picture of the FLIT school (a converted mess hall) and ending with a picture of a man who has successfully completed the USAFI and JRTT being presented with a certificate (ready to go on to job training).

In Figure 30, the reading worksheet packet assigned to the student will be for a table of contents, if it is the student's first week. In selecting

Figure 26

The FLIT School That a Man Enters After BCT—a Converted Mess Hall

Figure 27

A Man Taking the JRTT on His First Day in the School

Figure 28

A Man Taking the USAFI on His First Day in FLIT

Figure 29

After Testing, the Man Enters the FLIT Classroom and Meets His Instructor

Figure 30

The Instructor Assigns the Student a Job Reading Worksheet Packet

Figure 31

The Student Selects an Instructional Guide From a File Cabinet

Figure 32

An Advanced Student Selects His Job Manual

Figure 33

After Getting His Worksheets and Job Manual, the Student's Starting Time is Recorded by a Peer Timer/Scorer

Figure 34

Students Work on Job Reading Worksheets

Figure 35

Student Working on Forms Module

Figure 36

Student Working on Cook's Menu Cards

Figure 37

Peer-Scorer Records Accuracy and Time Scores on Student's Job Reading Records Sheet

Figure 38

Student Taking Proficiency Check Test at End of a Module

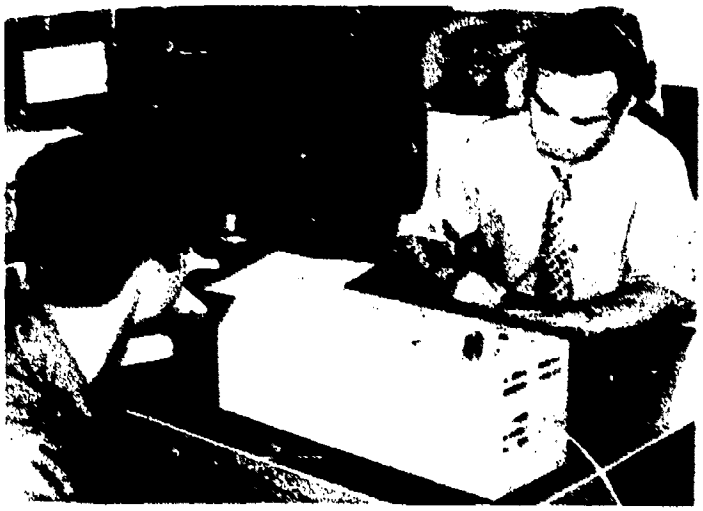


Figure 39

After the Last Proficiency Check for the Tables and Graphs Module, the Man is Administered the USAFI and JRTT Tests

Figure 40

Man Who Successfully Completed the USAFI and JRTT is Given a Certificate

an instructional guide (Figure 31) the student is receiving incidental training in filing skills. The instructional guides are photocopied parts of technical manuals that permit the student to focus on one part of the manual at a time. An advanced student uses manuals rather than instructional guides (Figure 32). After the USAFI and JRTT tests, if a man needs more instruction he is recycled through additional job reading.

This is the current job reading component of FLIT. As the development effort continues, we expect to modify this component and add job reading training that will emphasize basic word attack skills, higher level comprehension skills, and job concepts and principles. The current materials that we are using for word attack and comprehension are non-job related and make up the other major component of the FLIT curriculum—the developmental, or general reading, component. The students usually divide their time between three hours of job reading and three hours of general reading per day.

In addition to this experimental core curriculum, we have reading, writing, and discussion activities over which instructors have discretionary control. In designing the FLIT program, we are careful to leave some discretionary time to the instructors, so as not to stifle their creativity and interest.

Characteristics of FLIT Students

For the first 100 classes, 957 men entered the FLIT program. Detailed descriptive data were obtained from an extensive questionnaire administered individually to the first six classes. This practice was halted because of the length of time required for the interview. The questionnaire was later reinstated as a take-home item, so we have data for about 770 of the 957 men. In the tables that follow, numbers fluctuate because of missing information.

The ages and education levels of students in the first 100 FLIT classes are shown in Table 36. The median age is 19, and median years of education completed is 12. Over 50% reported having a high school diploma or GED equivalency, which contrasts sharply with the mean entry reading grade level of 5.4 in the data for the 454 men in the last 60 classes.

The ethnic groups represented in the FLIT program offer quite a variety, as Table 37 shows. Over two-thirds of the men are non-Anglo-American. About 25% of the men in the FLIT program up to now have been foreign born, with slightly less than one-half these men having lived in this country for one year or less.

The large range of ethnic groups and number of foreign born individuals imply considerable language variation, which Table 38 confirms. Here we see that, although English is the primary language for more than

Table 36

Age and Education Levels of FLIT Students—16 Classes

Age	N	Education	N
17	63	7	12
18	179	8	21
19	189	9	48
20	166	10	102
21	62	11	137
22	26	12	405
23	18	13	20
24	14	14	18
15+	53	15+	6
Total	770	Total	769
		High School Diploma	440
		GED	7
		No High School Diploma	329
		Total	776

Table 37

Ethnic Group and Foreign Born FLIT Students—Classes 1-100

Ethnic Group	N	Foreign Born	
		Time in USA (years)	N
Anglo-American	183	4+	56
Negro	152	3.0	27
Spanish-American	160	2.0	36
Polynesian	175	1.0	26
Other	92	0.5	66
Total	762	Total	210

60% of the sample, many of the men have a primary language other than English, with Spanish the next most common language.

It is clear from these data that much of the literacy problem at the FLIT school goes beyond students having inadequate reading, decoding, or word-attack skills; much of the problem is a language problem. In the FLIT job reading program, the man with marginal English language skills is provided practice in using these skills in working with job reading materials.

Table 38

Language Background of FLIT Students—Classes 1-100

Language	Students' Primary Language	Language Spoken in Home
English	503	428
Tagalog	54	58
Spanish	78	134
Samoan	64	67
Japanese	2	2
Chinese	7	7
Korean	20	23
Guamanian	26	24
Micronesian	3	3
American Indian	6	9
Total	763	755

Effectiveness of the Training Programs

The effectiveness of the FLIT program is indicated by (a) the number of people who reach criterion after going through each module; (b) the improvement in general and job reading test scores obtained in the first and last weeks of the FLIT program compared to such improvement obtained by other DoD reading programs and a no-reading-training control group; and (c) the number of men who achieve the minimal target objective of grade 7.0 performance on the job reading task tests. Each of these indicators of effectiveness is discussed.

As was indicated in Figure 25, each career cluster has a Table of Contents, Index, Tables and Graphs, Body of the Manual, and a Procedural Directions module.[1] Each component has a pre-test and a post-test.

Table 39 shows the percentage of students who successfully passed the pre-test for each module, the percentage who achieved the criterion level of performance after completing the module, and the percentage who did not complete the module. These data are for all six career areas combined, and include FLIT classes of 40 through 100.

It is clear from Table 39 that the Tables and Graphs module is the easiest, being successfully challenged by some 25% of the students, while

[1] The Forms modules do not have overall module pre- and post-tests for proficiency. Rather each form is its own separate "sub-module." Hence no pre- and post-test proficiency data are presented for Forms.

Table 39

Module Performance: FLIT Students

Module	N	Passed Pre-Test %	Passed Post-Test %	Did Not Complete %
Table of Contents	451	23	68	9
Index	450	21	58	21
Tables and Graphs	447	25	57	18
Body of Manual	437	3	57	40
Procedural Directions	376	12	38	50

the Body of the Manual (BOM) module is most difficult, with 3% of the students successfully challenging the module.

In regard to the Did Not Complete column, it should be pointed out that some students did not achieve proficiency in a given module in three recycles, and hence, as mentioned earlier, they were moved into the next module to make sure that all students had some exposure to all the different job reading tasks before the six weeks of school were completed. Attempting to achieve mastery did, however, result in a fairly large number of students (50%) who failed to complete the difficult Procedural Directions module satisfactorily. This module comes near the end of the program, and many slower learners had to be moved ahead to learn about their job forms without achieving criteria levels of proficiency on the Procedural Directions post-test.

The data of Table 39 indicate in *criterion-referenced* measurements of job-related reading that FLIT students are indeed acquiring job-relevant reading skills. Table 40 presents achievement of FLIT students in classes 1-53 in terms of *normative-referenced* measurement of general reading skills. The general reading test used is the USAFI Intermediate Achievement test, which is routinely used to screen students for Army literacy programs.

As Table 40 shows, 304 men participated in the first 53 classes (weeks) of the FLIT program. Tested at the reception station, they had an average reading grade level of 5.0. After BCT, and on the first day in the FLIT school, they were retested on general reading, and scored 5.9, which is .9 of a grade unit above their reception station score. This is the gain mentioned earlier when it was said that .9 of a grade level may be attributed simply to testing artifacts.

Table 40

General Reading: FLIT, Air Force, and Army APT Literacy Programs

Literacy Program	N	Average Grade Level			Unadjusted Gain	Adjusted Gain
		Reception Center	Week 1	Exit Week		
FLIT[a]	304	5.0	5.9	6.6	1.6	.7
Air Force	277	--	5.2	6.7	1.5	1.5
APT[a]	8,999	4.0	--	5.6	1.6	.7

[a]FLIT and APT are 6 weeks in duration; Air Force program is 13 weeks long.

The average exit score from FLIT was 6.6, a gain of 1.6 years if we compute gain in the FLIT program as the difference between the reception station and exit week scores, as is the policy in APT. The contrast with the Air Force and APT programs can be seen in the *Unadjusted Gain* column. In the *Adjusted Gain* column we have subtracted the .9 gain due to testing artifacts. On general reading, the FLIT gain is 0.7 years, which is .8 below the Air Force but equal to the current APT. With regard to the FLIT and Air Force differences, the Air Force program is explicitly geared to general reading, while the FLIT program is oriented toward job-related reading. In addition, the Air Force program is 13 weeks long, while the FLIT and APT programs are less than half that, at six weeks.

In terms of job-related reading, Table 41 compares a sample of students tested at the APT programs at Forts Knox and Ord, and the Air Force program, with men in FLIT classes 1-39 (major revisions were made to the FLIT program, including revisions to job-reading task tests, for classes 40 on. The job reading test data reported in Table 41 were all obtained with the original tests and are hence comparable).

The data of Table 41 clearly indicate the advantage of direct job-related reading training on performance of job reading tasks. The FLIT gain is three to four times that of APT of the Air Force.

To further evaluate the FLIT program following the revisions for classes 40 on, a group of Army personnel entering the Light Vehicle Drivers School at Fort Ord were tested for general reading and job reading ability on the first and last weeks of their job training. Thus these men received no general reading training or direct, extensive training in job reading as given in the FLIT school, although of course they were introduced to Army job reading materials.

Table 41

Job Reading: FLIT, Air Force, and Army APT Literacy Programs

Literacy Program	N	Grade Level		
		Enter	Exit	Gain
FLIT	149	6.8	8.7	1.9
APT	124	4.7	5.2	0.5
Air Force	56	6.1	6.7	0.6

Table 42 shows how well the FLIT students did on general and job reading task tests compared to Army personnel in the Light Vehicle Drivers School who scored below the 7.0 grade level on the USAFI general reading test on entry into their job training. We note that the students who received no literacy training improved 1.0 grade level in general reading—again reflecting gain that can be obtained simply through retesting at a later date.

Table 42

FLIT Students Compared to No Literacy Training Group

Students	N	General Reading			Job Reading		
		Entry	Exit	Gain	Entry	Exit	Gain
FLIT[a]	454	4.9	6.1	1.2	5.3	7.6	2.3
No Literacy Training	39	5.6	6.6	1.0	6.3	7.4	1.1

[a]Classes 40-60.

Regarding job-related reading, the FLIT students gained some 2 1/2 years, while the non-literacy-trained personnel improved by one grade level. Again, the effectiveness in direct training in job-related reading is demonstrated.

Table 43 shows the percentage of men in the FLIT school who scored at the minimum of 7.0 on the USAFI and JRTT at entry and exit from the program. It should be recalled that the cutoff score for entry into the FLIT school when the USAFI test is given at the reception

Table 43

FLIT Program[a]
Students Achieving Grade Level 7.0

	Reading Test			
	General		Job Related	
Testing	N	%	N	%
Entry Week	454	12	454	12
Exit Week	454	28	454	57
Gain		16		45

[a]Classes 40-100.

station is 6.1. Hence the data of Table 43 for the entry general reading test show how many people scored at or above the 7.0 level when retested during their first week in FLIT. As indicated, 12% of the people were at or above the 7.0 level when retested on the first day in FLIT, while at the exit week 28% obtained the 7.0 level, for a 16% gain in numbers achieving the seventh grade level in general reading.

We see a larger gain for personnel who achieved 7.0 on the job reading task test, with 57% of the men reaching the targeted level, representing a 45% gain in personnel achieving minimal job reading proficiency.

Summary of Developmental Effort

This, then, is the program, the people, and the progress of the FLIT developmental effort after 100 classes of input. We believe that the data obtained so far offer encouragement for continued effort.

As in the past, the FLIT developmental effort will continue to be guided by these principles which have proven successful in a wide variety of training contexts:

(1) Functional Training. Through the use of actual job reading material, the man sees the purpose for the reading training in concrete terms of job proficiency, not in general educational development, which they have failed many times in the past.

(2) Performance Orientation. This training permits the men to perform the kinds of reading tasks they will encounter in job training and out on the job; thus there is a direct transfer of skills learned in FLIT to the job.

(3) Individualization. Individualized training permits men to work at the rate suitable for them, and with materials oriented toward *their* jobs.

(4) Student Assistance. Students participate as instructional aides and peer-instructors to relieve pressures on teachers and to help "stamp in" what they learn in FLIT.

(5) Quality-Control. During training, quality control in the form of modular instructional units with end-of-module proficiency checks aims to provide students and instructors with immediate feedback about learning achievements and deficiencies, so that corrective action can be taken.

(6) Follow-Up. Questionnaires to follow up FLIT graduates provide feedback for making the FLIT job reading program faithful to the job training reading demands. Out of 353 follow-up questionnaires, we have had 74 (or 20%) returned. Eight out of 10 felt that one or more of the FLIT activities helped them in their job training, and several have suggested additional material to be included in the FLIT school. We believe that with this continued interaction between the development staff and FLIT graduates, gaps between job reading demands, job reading training, and personnel reading skills will continue to be closed.

Part III

Collected Papers on Functional Literacy

Introduction

The research and development projects described in Parts I and II of this volume are completed or ongoing efforts in HumRRO's literacy work for the U.S. Army.

In contrast, the three papers presented in Part III are not concerned with the description of past accomplishments. Nor are they restricted to HumRRO's Army work programs. Rather, they are thought papers—or opinion papers—concerned with the general problem of preparing citizens with literacy skills that will permit them to pursue successful and satisfying careers in the occupational area(s) of their choice.

Chapter 9 faces squarely many of the issues involved in teaching adults to read well enough to get into and complete a career education program. We consider what is implied if reading training is thought of in terms of a "medical model," in which such training is considered as "remediation," rather than an "education model," in which the language and knowledge components needed to achieve higher levels of literacy are assumed to require extended periods of time for growth and development.

Additional attention is given to questions such as: What are the reading requirements of career education programs? How good are existing "remedial" reading programs that aim to prepare people for job training or direct job performance? The chapter closes with recommendations for specific research and development projects aimed at tackling the problems involved in teaching reading to adults for career education.

Two general considerations in Chapter 9 are that career-oriented literacy programs must become more extensive than they presently are, and that, where feasible,

literacy and job-skills training should be integrated. In Chapter 10, these conclusions form the basis for recommending a comprehensive career-oriented literacy training system for the Armed Services. The data reviewed suggest that the volunteer-based Armed Forces will continue to draw significant proportions of personnel with low literacy skills; at the same time, literacy demands of military job training programs and jobs will stress the literacy skills of large numbers of inductees. The capability of current remedial reading programs for closing this reading skill — reading demand gap is questioned. An extended, integrated job-skills and literacy skills training system is suggested as an approach to upgrading the literacy skills of the people in the Armed Services in order to prepare them for *careers*—not just jobs.

Chapter 11, the final chapter, is a brief appeal for an approach to literacy in the secondary school system that would prepare students to perform the literacy communication skills demanded by the world of work. The typical secondary school English course is patterned after college-level English courses; it is, in fact, preparatory training for college work. The suggestion is that at least equal time and effort should be given to preparing students to perform the literacy skills tasks encountered in various career fields (e.g., the reading and writing of technical manuals or procedural guides).

Together, these last three chapters raise many questions about adult functional literacy training. Although discussed within the context of career-oriented reading, these questions are equally fundamental in more general contexts:

- How are we to construe the nature of adult reading tasks?
- How many adults lack the reading skills to perform these tasks?
- How effective are current adult literacy training programs?

These questions form the basis for a broad study of adult reading practices, problems, and programs. Our hope is that we have given impetus to this broad study here in Part III through a less ambitious effort: the study of reading for working.

Chapter 9

Reading and Career Education

The "War on Poverty" of the mid-sixties brought concern that many of the poor might be prevented from entering various career fields though lack of reading skills needed for jobs or job training programs.

This concern has been heightened during the seventies with the emerging emphasis on "Career Education": education oriented to helping individuals find a satisfactory life in the world of work. The Career Education Development Task Force (CEDTF) of the National Institute of Education expressed its concern for the role of reading skills in gaining entry into career education programs as follows (1, p. 138):

> Many career education programs, including the more successful ones conducted by private technical schools and training programs, select youths with sixth or eighth grade reading skills. *Many youths may be excluded from career education programs for deficiencies in basic skills.*

REMEDIAL READING TRAINING TO PREPARE ADULTS FOR CAREERS

To remedy this frequent lack of essential reading skills, remedial reading training is offered as a part of many of the job training programs sponsored under such directives as the Manpower Development and Training Act, and the Department of Defense's Project 100,000.

The rationale for offering remedial reading seems to go something like this:

(1) Certain levels of reading exist; other things being equal, attaining these levels will permit people to enter into and successfully complete job training programs.

Based on materials from an article entitled "Adult Reading Tasks," by Thomas G. Sticht and John S. Caylor, which will appear in *Designs for Teacher Training in Reading and Adult Basic Education*, T.A. Rakes (Ed.), International Reading Association, 1975, and a consulting report by Thomas G. Sticht for the Division of Career Education of the Northwest Regional Educational Laboratory, 1973.

(2) Certain people have not attained these levels of reading skill.

(3) Therefore they need "remedial" training to close the gap between their reading levels and the reading levels demanded by the job training or career education program.

Generally, when considering remedial reading training as a means of rendering adults more employable, the achievement of *rapid* improvements in reading skills has been emphasized. This is illustrated in the following CEDTF statement (1, p. 138):

> Concentrated remedial reading programs developed for military and industrial use are reported to be inexpensive and reliably successful. The Task Force will survey these programs and others developed through Job Corps and other programs. If the survey supports current impressions that these programs are effective, support will be requested for an experimental test of their use in conjunction with ongoing career education projects.

COMMENTS ON THE CONCEPT OF "REMEDIATION"

The concept of "remediation" expressed in the CEDTF quotation is used in connection with most adult literacy programs to improve job prospects. It reflects the "medical model" approach to education, in which some "normal" state of being is assumed to exist regarding—in this case—reading competence. The less apt person is considered "ill" if his reading competence is not "normal." Hence, a "remedy" for the pathological condition is needed. In the present case, the prescription is a quick shot of "remedial" literacy training to make the patient well and able to enter career education.

It is, of course, absurd to regard the lack of reading competence as a pathological state of the organism. The majority of the world's peoples are illiterates (2, p. 8), so, even on a normative basis, lack of reading ability is not a mark of pathology. To be unable to read is simply to be unable to read—much as to be unable to transmit and receive Morse code is simply the lack of being able to do just that.

Rather than viewing lack of reading competence from the perspective of medicine, we can regard it from the perspective of education and training. This results in an "education model" approach, which assumes that experiences in the world must *gradually* shape our cognitive content or knowledge structures so as to promote our survival. Accordingly, a "training model," as we conceive of it, provides structured learning experiences and practice opportunities that help promote the ability to communicate knowledge—first by oral language and later, with additional training, by written language. (We are excluding the deaf, blind, etc. from this discussion.)

If, however, written language is not used, or does not reach the facility that an authoritative judge would like, the result is not a pathological condition to be "remediated." Rather, it is a state of skills acquisition that needs further development. Furthermore, since the purpose of any language, written or spoken, is to communicate knowledge, the knowledge base (cognitive content, processes) must match the level of language performance (oral or written) that the judge expects. Otherwise, what might be construed as, for instance, a lack of reading skill, might actually reflect lack of knowledge.

Since education builds knowledge, and since the building of knowledge is a growth and development process requiring time, it follows that education requires time. Hence, reading training programs in which extensive knowledge bases must be built will require considerable time. It may be unrealistic, then, to expect to find "concentrated" reading programs (e.g., 100 to 200 hours of training in six to 36 weeks) that produce knowledge increments large enough to permit comprehension of the broad range and scope of written communication encountered in career *education* programs.

Similar concerns have been expressed by Carroll (3, p. 130): ". . . basic linguistic competence (at least with respect to grammar and vocabulary) is probably relatively unsusceptible to improvement except over long periods of time and with tremendous efforts. . . ." Bloom (4, p. 4) suggests that less than normal intellectual or educational growth at one period of life cannot be compensated for by greater growth at a later period. He supports this hypothesis on the basis of extensive literature review: "The data . . . suggest that this is true of many characteristics if the deficit is incurred over a long period of time and if it occurs relatively early in the individual's development."

If this thinking is accurate, the "medical model" approach may lead to unrealistic searches for rapid-acting remedies. On the other hand, the "education model" and "training model" suggest different expectations implying commitments to long-term programs to help young people succeed in career education. Such programs will be particularly important for persons interested in higher status career education programs that demand considerable conceptual learning from language—primarily, the written language. We can anticipate that the lower the entry level skill of the person and the higher the level of the career education program to which he or she aspires, the longer literacy programs will have to be. However, career education for lower or middle level career fields—those that do not make very heavy demands on literacy—is usually the main concern. Certainly, the professions—law, medicine, teaching—are excluded! For these reasons, this chapter focuses on reading training that prepares persons to read well enough to enter training for semiskilled and skilled occupations, such as food service, clerical, automotive, and construction.

ARE PEOPLE EXCLUDED FROM CAREER EDUCATION AND JOBS BECAUSE THEY LACK READING SKILLS?

Entry into some training and jobs is restricted to persons meeting certain credential qualifications—for example, a high school diploma, GED High School Equivalency, or a minimal score on some test, such as a sixth or eighth grade reading level.

For instance, during a visit to a prison we were told that a reading test score at the sixth grade level was required for entry into the shoe repair training program, while an eighth grade reading score was required for entry into training for mechanical drawing. In neither case, however, had any relationship been demonstrated between the credential requirement for sixth and eighth grade reading skills and the actual reading skills demanded by the job training. Thus, there was no knowledge of whether the credentials requirements were too high, too low, or just right.

In this regard, little information appears to be available today regarding the demand in various occupational fields for such knowledges and skills as reading, arithmetic computation, writing, speaking, and auding (listening to the spoken language). With regard to reading, the military service has used several methods for stating its job reading requirements (see Chapter 6). Outside the military service, however, little attention has been given to using empirical methods to establish the general reading levels needed to pursue study in career education programs.

For this reason, credentials requirements for some programs (including nonempirically established reading scores) may be spuriously high or even completely unnecessary The empirical methods used to determine the reading skill level requirements of military jobs could also be applied to civilian career education programs to ensure a closer match between credentials requirements and actual program demands. If this is contemplated, however, the relative merits of the various methods, as discussed in Chapter 6, should be considered.

Lack of knowledge about the reading demands of career education programs or jobs raises a question: If the reading demands of career education programs are not known, how do we know whether many youths may be excluded because they lack adequate reading skills? Most large organizations do not state reading requirements at all, at least not in a direct statement such as "sixth or eighth grade reading ability." A conversation with the director of federal training programs at the local Human Resources Development Department revealed only one training program—licensed vocational nurse—for which reading level requirements were stated as such (10th grade). Most programs make only *indirect* requirements for reading skills by using written aptitude tests—the General Aptitude Test Battery (GATB) and the Armed Forces Qualifying Test

(AFQT) are the most widely used—that require reading ability as well as other skills and knowledges for their execution.[1]

Educational and GED levels are frequently used for indirectly specifying reading (and other skills) requirements for career education programs. But such credentials requirements are frequently not validated against performance measures of achievement in the program. Hence, they are susceptible to the same criticism as credentials requirements for direct entry into jobs: they may be highly inflated.

Although it seems intuitively certain that many youths (and a fair number of the not-so-young) may be excluded from career education programs for deficiencies in basic *reading* skills, there is only indirect evidence to this effect.

In his summary chapter to a volume describing nine major manpower programs for training the disadvantaged for jobs—programs that include literacy training as key components—Doeringer (7, p. 249) states:

> While low levels of education and training can limit productivity and do affect the attractiveness of workers to prospective employers, unreliability on the job, rather than lack of skill, appears to be a more serious cause of ghetto unemployment.

It might very well be, then, that although certain minimal literacy skills are required to gain entry into jobs—skills for filling in application blanks, or for reading newspaper ads to find out about jobs—such skills may not be sufficient. Behavioral actions such as tardiness and absenteeism appear repeatedly in discussions of programs involving the so-called disadvantaged and may bias employers against hiring them.

Besides reading, other communication skills may affect the employability of youth. Shuy (8) reported research that asked the question: "Is speech really an important criterion in employability?" Employers were asked to listen to taped voices of Negro male adults and teenagers from the complete range of socio-economic status groups in Washington, D.C. and indicate whether they (the employers) would hire the person speaking, and for what position. Employers represented work in the hotel, telephone, dry-cleaning, baking, lumber, drug, and newspaper businesses.

Results of the study indicated that speech characteristics did, indeed, influence the speaker's employability. Of four lower-working-class tape speech samples, an employer at a men's clothing store picked two as unemployable. The other two he would hire as porters, or as receiving-

[1] Regarding the AFQT, the lower limit set by Congress for entry into the Armed Services is the 10th percentile. By regression analysis, this corresponds roughly to sixth grade reading ability as measured by two different standardized tests (Sticht, *et al.*, 5; Caylor, *et al.*, 6).

room workers with no public contact. The following interesting conclusion, reported by Shuy, needs further confirmation:

> Most of the employers in our study consciously denied that speech is a consideration but they unconsciously reacted with amazing uniformity in assigning jobs on the basis of very few linguistic cues. The better jobs invariably went to the standard speakers. Those who were judged unemployable were invariably those with a lesser degree of standard English.

An implication of such findings is that interviewing employers to ascertain important skills for employability may fail to reveal important characteristics of a potential employee, because the employer is unaware of the extent to which his decisions are influenced by subtle (and perhaps not so subtle) behavioral displays, such as nonstandard English usage.

No conclusive evidence has been found to indicate that many youths are being excluded from career education programs for deficiencies in basic reading skills. However, there is some evidence that many people—young and old—may not be able to read well enough to use newspaper ads to find a job, or to fill out job applications accurately enough to gain employment.

Concerning the reading of newspaper ads, a recent nationwide survey (9) tested adults 16 years old and above on, among other things, their ability to read three employment ads typical of those found in major U.S. newspapers (except that no abbreviations were used). Respondents were shown three cards, each containing one advertisement. The following example is taken from the report:

> If you're looking for an interesting job, work as a secretary in our law firm. Skills necessary—typing. Benefits include full medical insurance.

Respondents were asked three questions drawing upon the information contained in the job ads. For the above example, the questions were:

> (1) Would you please look at this ad and tell me what job is being offered?
> (2) How does the ad describe the skills necessary for this job?
> (3) How does the ad describe the benefits that come with the job?

Respondents viewed three ads and were asked three questions for each ad, making a total of nine correct answers possible.

Data analyses indicated that, for the population as a whole, 92% answered nine out of nine correctly, while an additional 7% answered seven or eight items correctly. However, comparisons of whites with blacks showed a large difference: 95% of whites got nine out of nine correct, but

only 70% of blacks got all items correct; 89% of blacks got seven or more items correct. Of respondents reporting incomes less than $5000, 83% got nine out of nine correct. Perfect scores were obtained by 75% of those reporting less than an eighth grade education.

These results indicate that less educated, poor, and black respondents are less able to perform the critical task of reading simple employment ads with complete facility. It should also be noted that, in this task, the interviewer asked the questions orally and also filled in the response on the answer sheet. Thus the task was less difficult than in the usual situation where the respondent is required to form his own questions and jot down the key information.

Additional information about the reading of want ads was obtained by the Texas Education Agency in its Adult Performance Level (APL) project (10). This project tested the functional reading ability of some 4000 adults involved in either an adult learning center, an employment-oriented program such as the Work Incentive Program, or a correctional or penal institution. About 40.5% of the sample were males. The mean age was 28.6. In ethnic designation, 31.6% marked Anglo, 34.8% Black, 16.7% Mexican-American. The remaining were Oriental (1.0%), Indian (1.6%), other, or no response.

Within a larger test battery, respondents were given three test items that required the extraction of relevant data from the newspaper employment ads shown in Figure 41. The exercise was included to assess reading and communication skills in an occupational-referenced situation.

The three test items were:

Item 20

Which of the following jobs requires a resume?

Xa. bookkeeper
b. permafoto plaque salesman
c. Avon saleslady
d. I don't know

Item 21

Which of the following ads specifically asks for a woman?

a. laboratory technicians
b. Avon lady
Xc. "Maybe you can help me."
d. I don't know

Item 22

If you want to live outside the city and work with animals, to what address would you write?

a. Box M-195, American Statesman
Xb. P.O. Box 1988
c. P.O. Box 2052, Austin, Texas
d. I don't know

Figure 41

Newspaper Employment Ads Used to Assess Reading and Communication Skills

Monday Through Friday

EMPLOYMENT

45—HELP WANTED—
Male, Female

LABORATORY TECHNICIANS NEEDED, IMMEDIATELY—Experience required. Service Vets preferred. 31 med. facilities. Austin, Texas. Contact Administrator phone 713-542-3143. Lee Memorial Hospital, Box 209, Grading, Texas 78927.

VERSATILE INDIVIDUAL to help in contemporary art gallery. Wednesday - Thursday - Friday afternoons. Write giving personnel data and background. Art Galleries. 404 West 30th.

SHARP!
GUYS - GALS

COLLEGE MEN AND WOMEN - OR SOME COLLEGE PREFERRED. For most of you now going to school that need a job for the holidays - possibly work part time once back in school.

$550. PER MO.

guaranteed if you meet our requirements. Car necessary. Must be available immediately. Full or part time. Call GR 7-3749.

EXPERIENCED BOOKKEEPER
Female or Male

Liberal salary to qualified person. Ideal working conditions, 5 days. Inquiries held in strictest confidence. Send resume to:

BOX M-915
AMERICAN-STATESMAN

COUPLE TO raise chickens. House and utilities furnished. Must have some experience. Located near Austin. Excellent opportunity for someone willing to work. Reply qualifications to P.O. Box 1988.

47—SALES—
Men - Women Wanted

RED CARPET Products—full or part time positions - in business 25 years. 477-4461

SELL FOR one of the world's leading producers of management training and motivation programs. Exciting and growing business opportunity. We train. Small investment. 926-6932.

BRANCH SALES Manager for Morgan Portable Building Company in Austin. Must be a good closer. Earn $12,000 to $18,000 first year. No travel. Unlimited potential. 454-8747.

PERMAFOTO PLAQUE salesmen wanted. Good commission plus monthly bonus. Photo-Graphics Inc., 836-7240 for interview.

WAGES FROZEN?

Not ours. I just had a 100 percent increase over last week. No freeze when you have your own beautiful Viviane Woodard Cosmetics business like I do. The only ceiling is your own desire. For further information phone 452-3634. Viviane Woodard Cosmetics, a subsidiary of
GENERAL FOODS CORP.

MAYBE YOU CAN HELP ME!

I'm looking for a beauty conscious woman who likes people and wants to make money! Does that sound like someone you know? Call 452-3614.

EVER WONDER WHAT YOU ARE WORTH TO ANOTHER COMPANY? You may be satisfied with your present position, but you owe it to yourself to look into the position we have to offer. Private and confidential interviews. Send resume to Box 2052, Austin, Texas.

AVON
DON'T BE "STUCK"
INSIDE THIS WINTER

Get out, meet people, make friends. Be an Avon Representative. Have your own business during hours you select. Earn extra money. Call now:

477-8261

Source: *The Adult Performance Level Study* (10).

Results indicated that, for item 20, 64% gave the correct answer, 22% were incorrect, and 14% didn't try. Item 21 showed 56% correct and 32% incorrect, and 12% didn't answer. Item 22 showed 62% correct, 26% incorrect, and 12% no response. Differences among age groups ranging from below 20 years to 41 years and above were trivial.

From these data it appears likely that many persons, including young people, might be so little developed in reading skills as to be unable to use newspaper want ads to find a job. The results of the two surveys are especially impressive (or depressive!) because the questions asked are, at least subjectively, very easy and straightforward.

Inability to read newspaper ads with facility obviously limits the information about jobs available to the poor reader. Yet it may not be a major drawback to employment because most jobs are obtained from information provided by friends or relatives, employment agencies, or direct contact with employers (11). A more serious problem may result from the inability to fill out application forms, a task encountered in applying for jobs complicated enough to require a training program.

The Harris survey (9) indicates the numbers of adults who can be expected to have difficulty in filling out job application forms. The survey asked respondents to fill in a form containing the following seven major subsections:

> Section 1: Personal Identification Series (10 items: name; place of birth; sex; age; etc.)
>
> Section 2: Employment Series (4 items: current employment status; job; previous employer; etc.)
>
> Section 3: Income Series (3 items: total annual income; bank; etc.)
>
> Section 4: Housing Series (8 items: telephone number; number of rooms; etc.)
>
> Section 5: Automobile Series (3 items: automobiles owned; driver's license; etc.)
>
> Section 6: Medical Series (3 items: number of visits to doctor; insurance policies; etc.)
>
> Section 7: Citizenship Series (6 items: country of citizenship; passports; etc.)

The test form was a synthesis of items from the following forms: the Social Security form, the application for public assistance, the application for Medicare, an application for a driver's license, the original claim for unemployment benefits, the Selective Service System current information questionnaire, the United States individual income tax return form, the U.S. passport application, a typical credit card application, and the United States census form. In filling in the form, respondents were permitted to use fake data if they did not want to reveal actual, personal information.

Table 44 summarizes selected information as to how well certain groups performed on each section of the application. Table entries show the percentage of respondents in the different groups who correctly filled

Table 44

Percentage of Respondents Scoring 100% Correct On Each Section of an Application Form

Type of Information	Number of Items	Ethnic Group			Income	Education
		Total	White	Black	Under $5000	8th Grade
Personal	10	93	94	75	85	78
Employment	4	85	86	72	76	71
Income	3	77	78	67	74	70
Housing	8	87	88	72	83	80
Automobile	3	97	99	92	96	92
Medical	3	86	87	79	85	82
Citizenship	6	87	89	71	80	71
	Median	87	88	72	83	78

in all items for a given section of the form. Once again, the highly intercorrelated factors of being black, poor, and undereducated routinely exhibited performance levels below those of the total and white populations.

To obtain some idea of the reading problem implied by these data, we can extrapolate from this representative sample to the general adult population of adults 16 years of age or older. Using 87% (the median for the *total* group) as the most probable proportion of respondents to get any one section of the application form completely correct, at least 13%, or 18,362,500 adults, would fail to complete the form with 100% accuracy.

If a person were permitted one mistake in a given section, some 4% or 5,600,000 Americans would fail the section, according to the report. These proportions would, of course, increase for the blacks, the undereducated, and poor groups.

The Texas API. study (10) provides further information about the extent to which adult employment problems may result from difficulties in filling out application forms. Data were reported as to how well adult education students completed 12 items selected from a more extensive form (see Figure 42).

Summing over the 12 items, the average percent correct was 73%, with little appreciable difference among age groups. For the most part, errors were due to omission of information, except for item 3 (address);

Figure 42

Form Used to Assess the Ability to Fill Out Application Forms

EMPLOYMENT APPLICATION
FORM 5-45 Rev. 2-70 (PRINTED IN USA)

An Equal Opportunity Employer

Answer All Questions
If Question Does Not Apply, Write N/A

First Name 1	Middle Initial	Last Name	Telephone No. 2
Your Present Address (Number, Street, City, State & Zip Code) 3		How Long at This Address 4	
Type of Work Applied For 5	Salary Desired 6	When Could You Start 7	
U.S. Citizen? 8 Yes ☐ No ☐	Do You Speak Any Foreign Languages: If So, List 9		
Marital Status Single ☐ Married ☐ Divorced ☐ 10	No. of Children 11	No. of Dependents 12	

Source: *The Adult Performance Level Study* (10).

49% got this item correct, 34% filled it in incorrectly, and 17% made no response. The "address" item was scored incorrect if the person gave a street address, but not the city or state information. Thus, this test measures both the propensity to provide complete information in the form task, and the ability to read and write the needed information, without indicating which factor is dominant. These data indicate that persons of low reading ability might not fill out an application blank with sufficient information to get employed; however, they do not indicate that such failure is due to reading or writing difficulties.

Despite a certain ambiguity in the Texas research findings, the Harris and Texas studies together support the conclusion that reading newspaper ads and filling out application blanks are reading-related tasks that might pose difficult, if not insurmountable, employment obstacles for large numbers of adults.

Reading to Learn a Job Versus Reading to Do a Job

Needs for "basic skills" may be defined in terms of prerequisites for career education programs as contrasted with "basic skills" needed to actually *perform* the job tasks making up the career field. The distinction is between the skills needed to *learn* a job and the skills needed to *do* a job. Frequently, career education courses use textbooks that must be read

to pass the course, and these textbooks may make much greater demands upon reading skills than the jobs themselves.

Butz (12) used a modified Dale-Chall readability method to assess the reading grade level of difficulty of vocational texts in 29 occupational training courses offered in four vocational training centers in Michigan. He found that more than half of the texts demanded 11th grade or higher reading skills, while 70% of the students expected to use the materials read below the 11th grade level (students were juniors and seniors in high school).

Yet it is unlikely that job encumbents in the occupations studied actually have to read materials of such length and complexity, or that they have to read them for the same purpose—that is, to learn job concepts. According to research on the nature of on-the-job reading tasks typically performed by American adults (16 years old or older), most such tasks seem to involve reference skills—that is, looking up information of immediate concern rather than reading to form and retain new concepts. In a recent national survey conducted by Educational Testing Service (ETS) for the U.S. Office of Education (Sharon, 13, p. 16), respondents were asked what reading they had done hour-by-hour on the day preceding the interview. Results showed that:

> The most common type of reading is the reading of notices or signs in which about 1 out of every 5 persons engage for an average of 5 minutes. Letters, memos, or notes are also popular at work as they are read by 16% for an average of 16 minutes. Among other frequently read items at work are manuals or any written instructions which are read for an average of 17 minutes; forms (21 minutes), order forms, invoices, or account statements (20 minutes); schedules or lists (7 minutes); telephone or address books (13 minutes); reports, pamphlets, or articles in publications (19 minutes); labels or writings on packages (6 minutes); catalog, brochure, or printed advertising (9 minutes); specific work-related materials (30 minutes); and legal documents (29 minutes).

These findings suggest that much on-the-job reading involves the short-term processing of information for more-or-less immediate use, rather than reading to add new concepts or other forms of knowledge to one's store of information.

Limited data supporting this interpretation come from examining job reading tasks in the automotive mechanic, commercial cooking, and clerical career fields in the U.S. Army (see Chapter 3). In this research, employees (servicemen) working as automotive mechanics, supply clerks, and cooks were asked to report recently completed job tasks for which they had used reading materials. They were also asked to show what materials they had used and what they had used them for. Results showed

that most job reading involved looking up some piece of information—for example, how much torque to apply to a wheel nut—or following some procedural direction, or extracting some factual information from a table, graph, or picture. In other words, the materials were referred to for specific information useful for accomplishing the task at hand.

Thus, the *reference* nature of job reading tasks seemed to typify the reading tasks involved in *doing* a job. Reading to "comprehend main ideas," "critical reading," "drawing inferences," and other "comprehension skills" did not typify such tasks. As mentioned earlier, the latter tasks would presumably be more important in *learning* a job (e.g., in career education), because they involve actively imposing organization on what is read. And such organizational processes apparently aid in remembering what is read for long periods of time.

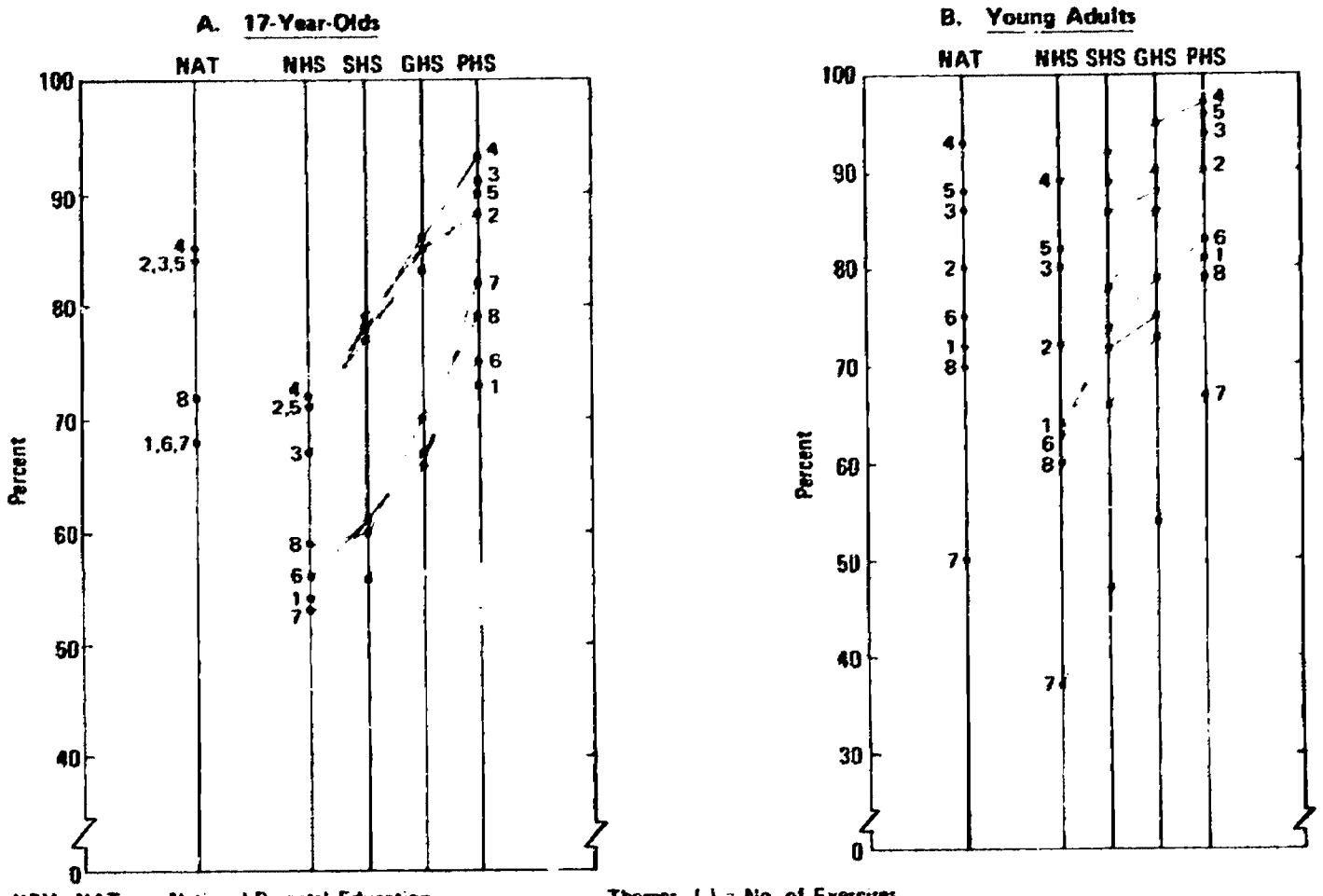
The "reference" and "comprehension" skills are strikingly differentiated in the summary of the National Assessment of Educational Progress in the area of reading (14). This assessment presents data for 9-, 13-, and 17-year-olds and young adults (25-35 years old) on reading task representing eight themes:

(1) Word Meanings. Understand word meanings in isolation and in context.
(2) Visual Aids. Interpret drawings, pictures, signs, labels, charts, graphs, maps, forms.
(3) Written Directions. Understand and carry out written directions.
(4) Reference Materials. Know appropriate reference sources; use reference materials correctly.
(5) Significant Facts in Passage. Recognize and retain factual information; understand relationships among facts.
(6) Main Ideas and Organization of Passages. Identify main ideas (identify topics; identify central thoughts); discover organization.
(7) Inferences From Passages. Draw inferences from information given and from given plus additional information.
(8) Critical Reading of Passages. Understand literary devices; recognize mood and time; discriminate fact from opinion; recognize author's purpose; recognize and evaluate sources.

Figure 43 reproduces Figures 8-5 and 9-5 from the Reading Summary report (14). These figures report performance data for 17-year-olds and young adults on tests representative of the eight themes. Data are presented for the total sample (column labeled NAT) and for subsamples coming from families where the parents had no high school education (NHS), had had some high school (SES), had graduated from high school (GHS), or had some education beyond high school (PHS).

Figure 43

Performance on Reading Tests Representing Eight Themes, by Parental Education



KEY: NAT = National Parental Education
NHS = No High School
SHS = Some High School
GHS = Graduated from High School
PHS = Post High School

Themes—( ) = No. of Exercises
1. Word Meanings (14)
2. Visual Aids (48)
3. Written Directions (33)
4. Reference Materials (34)
5. Significant Facts (42)
6. Main Ideas (17)
7. Inferences (38)
8. Critical Reading (21)

Source: National Assessment of Educational Progress. Report 02-R-00: Reading: Summary, May, 1972 (14)

Two major conclusions can be drawn from these data. First, the influence of parental education is overwhelming. The higher the educational level of the respondent's parents, the better the respondent's reading performance. Since being black, being poor, and being poorly educated are highly intercorrelated phenomena, these data are coordinate with the data from the Harris Survey, described earlier, in showing the pervasive influence of the "culture of poverty" on reading performance (ability).

A second conclusion of special interest to the present discussion is the order of difficulty of the various "thematic" reading tasks. Best illustrated in Figure 43 for the 17-year-olds, but also found in the rank-ordering of tasks for the young adults, is the fact that tasks identified in this chapter as reference tasks are grouped together as the easier thematic tasks (themes 2, 3, 4, 5), while "comprehension" themes are grouped together to form the more difficult thematic tasks (themes 8, 6, 1, 7). We interpret these findings as supporting the distinction between the reading used to *do* a job and the reading used to *learn* a job.

Taken as a whole, these data strongly suggest that many adults perform relatively simple reading tasks, such as reading newspaper ads, filling out application forms, and extracting information from reference sources, with levels of skill low enough to reduce their chances for locating and entering career education programs, or entering directly into a job.

However, this does not mean that lack of adequate reading skills is the sole, or even the major, reason why young adults may fail to enter career education programs. Adequate reading skills may be necessary for getting into many programs, but they certainly do not *guarantee* entry or success in the program. As Doeringer (7) points out, employer expectations about a prospective job trainee's work habits (tardiness, absenteeism, etc.) may be more influential than reading skills in determining whether or not a person will be selected for job training. Our conclusion is simply that, along with other factors, inadequate reading skills may exclude many youths from career education programs. It seems desirable, therefore, to seek ways of educating and training these young people to read well enough to mitigate reading as a factor blocking access to and success in career education programs.

Prospects for "Remedial" Reading Training

This section is concerned with the problem of providing the reading training needed to prepare young adults for career education. However, a preliminary point to be made is that it does not seem sensible to train young people to meet career education entry requirements that do not accurately reflect the skill demands of the tasks comprising the career education program. Inflated credentials or invalid (or even valid) aptitude

test scores may bar admittance to many career education programs. In our opinion, vigorous legal action should be pursued to remove these barriers.

An alternative approach, such as the one used by the Workers' Defense League (Pinkus, 15) is to drill people in taking aptitude and intelligence tests that bar entry into jobs. This is very close to "teaching the test." Although the WDL has been successful in placing persons in apprenticeship programs, this success hinges on the stability of the aptitude test. In some cases, where new tests were introduced, WDL tutors were unable to anticipate their nature. Accordingly, success in "test-busting" drastically declined, as shown by the failure of WDL trainees to gain entry into job training programs (15, pp. 184-186).

Our assumption is that it is in society's interest to improve a person's ability to do the reading tasks involved *both* in gaining entrance into *and* in successfully participating in a career education program, rather than to simply improve the likelihood of a student's passing a particular test for a particular training program by training him or her in test-taking.

Regarding job-related reading training, the most extensive survey and evaluation of programs that we know about is the Systems Development Corporation study headed by Kent (16). The purpose of the project was "the collection and analysis of information relating to . . . existing Adult Basic Education programs which can be used in an on-the-job setting."

Starting with some 80 candidate programs, the SDC group reduced the number to 15 sites to visit and evaluate. The other programs were eliminated for a variety of reasons: they had closed, or were just starting up; they would not permit visits; they had no data on design and effectiveness; they had no explicit goals or theoretical basis of some scope; they had not demonstrated viability in a realistic on-the-job setting; they were not comprehensive enough in staff training, outreach, instruction, placement, facilities, and so forth.

Programs visited included: Los Angeles City Schools; Skill Advancement, Inc., in New York City; the Midwest Coop in several midwestern states; University of Arkansas; International Laborers' Union Local 423 in Columbus, Ohio; NARTANS in Los Angeles (a North American Rockwell subsidiary); Republic Steel Corp. in Cleveland, Ohio; BOLT, Inc., in New York City; Project GO in Washington, D.C.; Bell Telephone Co. in New York City; Atomic Energy Commission in Richland, Wash.; Oak Ridge Associated Universities in Tennessee; Riegel Paper Company, Riegelville, N.C.; Eastman Kodak Co., Rochester, N.Y.; and Rutgers University projects for unions and employers in New Jersey.

Concerning data on program effectiveness in increasing student achievement in reading and arithmetic, it was found that nearly half of the programs did not conduct post-testing to determine students' educational gains. Of those that did conduct post-tests, only four maintained scores so that they could be used—and these involved several different tests. The

report states: "Taken as a whole, the results are not very useful. The data are scanty and so dissimilar that comparisons among projects are next to impossible."

The report provides data for only two programs. In the University of Arkansas project, data for an unspecified number of students showed gains in reading of from 0.7 to 1.8 grade levels in 46 to 300 hours of Adult Basic Education (math gains ranged from .98 to 2.2 years). For nine people in the Skill Advancement, Inc. program, an average reading gain of 0.5 grade level was reported for 120 hours of ABE (math showed a 1.47 average grade level gain for 10 persons).

Such data are meaningless in deciding among alternative programs to be used in job reading training. Similar difficulties plagued the research of Schrank and Stein (17), two Ford Foundation consultants who attempted to obtain information about the relation of reading training to job training programs. They hoped that such information would " . . . make employers, program planners, and operators aware of what has been accomplished in other programs, and how much time was required. In addition such a survey should show employers and trainers that programs beginning with first or second-grade readers are unlikely to raise students to minimal employment literacy in a short time" (17, 41). They also pointed out that many job-related basic education programs may hold unrealistic expectations nourished, at least in part, by overly optimistic claims of many of the new "educational training corporations" that surfaced with the War on Poverty and manpower development and training programs.

The Ford Foundation study included the military services. However, the data provided must be disregarded because of obvious misunderstandings on the part of the researchers (e.g., stating reading grade "gain" as measured by the Armed Forces Qualification Test ("AQT")—a double error since the AFQT does *not* provide a measure of reading gain, and AQT should be AQB, the Army Qualification Battery, a separate test Battery from the AFQT), and a failure to correct gain scores for retesting effects. We will present data for military programs later on.

In reporting the results of their survey, Schrank and Stein produced a list of conditions that completely invalidate their results for the purpose of comparative evaluations of programs: (a) progress and achievement tests varied from program to program, so measurement of gains was not strictly comparable; (b) entry grade levels varied extensively, so that a gain from fourth to fifth grade level may be compared with a gain from second to fourth grade level; (c) no data on the variability in scores within programs (i.e., standard deviations) were reported; (d) teacher-student ratios, curriculum, goals and objectives, qualification of teachers, classroom atmosphere, location of training (i.e., near the work place versus in a distant classroom)—all were different, making it impossible to compare various programs.

Without these factors being taken into account, the authors concluded that, on the average, 90 hours of training are required to achieve one grade level of gain in reading. Of the 13 programs surveyed, the minimum number of hours for one grade level gain was 25 (although the same commercial program took 88.5 hours for one year's gain at a different job-training location). The maximum was 300 hours. Neither the SDC nor Ford studies reported data on the retention of gain in reading, nor future growth of reading following the completion of the program.

If 90 hours of training for a gain of one grade level represents the normal gain in job-related reading programs, it appears that "concentrated" programs are not accelerating the rate of learning to read. They produce a year's growth in reading in about the same amount of time given to an adult education course in a year. (The average one-year college course meets three hours per week for some 30 weeks or 90 hours per year.) Thus, it appears that the industrial programs surveyed do not use exceptional techniques that enable them to "concentrate" learning to read. Rather, they appear to use conventional techniques, increasing their rate of presentation to more than three hours per week.

The military services, like many of the industrial programs included in the foregoing surveys, offer literacy training to marginally literate personnel with the hope of improving their job proficiency. Also, like other large organizations, the military services have judgementally set criterion literacy levels. Their hope is that these levels can be achieved in relatively brief training programs and that the job proficiency of personnel will improve enough to keep them employable.

For the Army, the targeted reading level is grade 5.0 (see Chapter 8). The Air Force sets the 6.0 reading grade level as its target for literacy training (see Chapter 10). The Navy has no fixed goals, but turns out men whose average reading level is grade 5.5 (see Chapter 10).

The various programs in the services use completely separate instructional methods, so there is little consistency across programs. At the time of this writing, the Army was providing literacy training for six weeks of six hours a day in five Army Preparatory Training (APT) programs. Each program was conducted separately, with approaches ranging from the "conventional" classroom—with the teacher at the front talking to the students—to extensive use of automatic equipment from the Educational Development Laboratory.

There are no appropriate data available (or possible to obtain) regarding the relative effectiveness of the different programs. Careful study of the APT system (see Chapter 8) indicates that much of the success of these programs consists of improving students' reading levels from fourth grade to fifth grade, and that as many as 50% of the improved cases may be due to regression or other testing artifacts. There are no data indicating that the Army's literacy training impacts beneficially on later job proficiency.

The Air Force conducts its reading training in one location at Lackland Air Force Base, San Antonio, using the Job Corps program. This program consists of commercially available kits and tests, arranged in a systematic program of self-paced, individualized study. It is supplemented by a one-week phonics training program. The Air Force program runs four hours a day for 13 weeks (260 hours); its goal is to produce readers of sixth grade competency.

In an unpublished report by Zaccaria (18), data for 277 trainees indicated pre-test reading scores of 5.2 grade level, and post-test scores of 6.7, with an average gain of 1.5 grade levels. This gain held at 1.2 some 4 to 6 weeks later when the men were retested following basic military training, indicating some retention of the newly gained reading skill. Official Department of Defense figures for 3,288 men completing Air Force reading training show a 1.4-year gain in some 173 hours of instruction (19). As with the Army, there are no adequate data on the impact of current Air Force literacy training on subsequent job proficiency.

Although no data bearing on the effects of *current* military literacy training programs on job proficiency have been found, the Army, Air Force, and Navy have made several attempts to evaluate the effects on job training or job proficiency of literacy training up to the fourth or fifth grade level. Summarized in detail in the book *Marginal Man and Military Service* (20), these studies failed to demonstrate the benefits of literacy training on either job training or job performance, regardless of the measure used—supervisor's ratings, retention, pay scale achievement, conduct, or others. However, these studies also failed to demonstrate that the various literacy training efforts actually improved reading skills over those of control groups—where such comparisons were made. If proficiency in reading is not genuinely improved, it is meaningless to search for the effects of such nonimprovement on subsequent measures of job training or job performance proficiency.

Although the problem may seem fairly straightforward, evaluating the effects of literacy training on job training and job performance proficiency is fraught with many difficulties. What should the measure(s) of job proficiency be? If hands-on job sample tests are used, will limited literacy training have any effect on such performance measures?

Work by Vineberg and Taylor (21) compared the job proficiency of men given job training (eight or so weeks of school training, not reading training) as Cooks, Vehicle Repairmen, Supplymen, and Armor Crewmen to that of men given on-the-job training. The proficiency measures were job sample tests based on task analyses of these jobs.

Results indicated that, for Repairmen and Cooks, there was a statistical (but not practical) difference in favor of the men given formal job training; however, there were no statistical or practical differences between

the formally trained and on-the-job trained Armor Crewmen and Supplymen. (In these comparisons, effects of AFQT, time on the job, education, and age were controlled by covariance techniques.)

If eight or more weeks of formal *job* training may have little or no effect on subsequent job sample test performance in these jobs, is there any reason to believe that four, six, or even 13 weeks of *reading* training will be reflected in such measures? Probably not. Many job tasks can and will be learned by "show-and-tell." This is especially true of tasks of high frequency and criticality—the types of tasks emphasized in task analyses and typically used to construct job sample tests.

Furthermore, except for the profoundly illiterate (e.g., persons reading below the grade 2.0 level)—which most of the military reading students are not—it seems unreasonable to expect four to six weeks of literacy training to significantly affect retention rates, rate of promotion, conduct (AWOLs; courts-martial), paper-and-pencil job knowledge proficiency test scores, or supervisors' effectiveness ratings. For the profoundly illiterate to improve on any of these indices would be contingent upon successful literacy training up to some requisite level. The Air Force report by Zaccaria (18) suggests that it is difficult to effect much reading improvement with such personnel in even 13 weeks of reading training. In this study, 85% of the men who entered reading at the first grade level exited reading at or below the fourth grade level. Ninety percent of men reading at the second grade level on entering the 13-week program exited reading at or below the fourth grade level.

Perhaps the most reasonable criterion measure of job proficiency against which the effects of reading training might be evaluated would be measures of a person's ability to perform necessary job tasks involving reading. Necessary reading tasks could be defined as those that a person would have to perform if he were working alone on the job and had no one to turn to for help in doing a job task. This is a somewhat artificial situation, since it is rare for personnel to work under such restrictions. Usually the marginally literate person can rely upon someone more literate to handle the reading needed in various job duties.

However, sometimes it is desired that each individual be able to perform all significant job tasks, including the reading tasks. In such cases, it seems reasonable to evaluate the effectiveness of literacy training by comparing the performance of graduates of the literacy training program with that of persons of equal pre-literacy training reading skill levels on job reading task tests. If reading training does not improve a person's ability to perform significant job reading tasks, it seems unlikely that the reading training will affect other, less directly reading-related indices of job proficiency, such as retention rates, supervisors' evaluations, job sample tests, and so forth.

On the other hand, it does not necessarily follow that improved competency in performing job reading tasks will be reflected in other,

nonreading-related indices of job proficiency. In fact, data from HumRRO (see Chapter 4) indicated that job knowledge and job sample test performance for the four jobs mentioned earlier correlated only about .5, while supervisors' ratings did not correlate at all with either of the other indices of job proficiency. Thus, there is evidence to suggest that improvement on one index of job proficiency—e.g., the use of job reading materials—will not necessarily be reflected in improvements on other indices of job proficiency.

Research evaluating the effects of Air Force and Army literacy training programs, and a special, experimental, job related-literacy training program being developed for the Army by HumRRO, indicates that all three literacy training programs resulted in improved job reading task test performance (see Chapter 8). Furthermore, the HumRRO program, which focuses reading training directly on the performance of job-related reading tasks, produced considerably greater improvement (one to two grade levels) than the Air Force and Army programs, which provide general literacy training.

Thus, limited evidence suggests that relatively brief periods of literacy training can produce an improved ability to perform job-related reading tasks. Additional research indicates that control groups of marginally literate men not submitted to literacy training, but given job training, did not acquire comparable levels of proficiency in job reading tasks performance as a consequence of this job training (Chapter 8).

It seems reasonable to suppose that the improvements effected by the relatively brief programs of literacy training offered by the Air Force, Navy, and Army (including HumRRO's experimental program) will be short-lived. This seems likely because:

(1) The objectives of these literacy training programs do not seem to meet the demands of the reading tasks encountered in even the least demanding jobs. (Even the experimental HumRRO program is targeted at producing the ability to perform job reading tasks with the proficiency of a person having general reading skills of grade 7.0—and this meets the minimum requirements only for the Cook's job). For this reason men may be frustrated in trying to deal with reading materials that exceed their reading skills, even after graduation from the reading program. Thus, they may avoid job reading, which results in a decline in reading skills to pre-literacy training levels.

(2) Most job training programs that men attend after literacy training make little attempt to help men use their job training materials by providing usable glossaries, carefully sequencing new information, and so forth. They may even permit the less literate men to avoid reading by encouraging more literate men to do all of the "looking up" of information and reading of procedural directions.

(3) No systematic efforts are made to continue to stimulate the less literate man to continue his reading development after completing

literacy training. No job-related, developmental reading materials are provided; no encouragement or incentives to continue reading development are provided; no officially scheduled time for continued literacy development is provided.

These conditions seem similar to those that encourage many students in civilian life to discontinue their development and exercise of reading skills, which in turn necessitates literacy training in the military services. (Chapter 10 proposes a career reading training system that could allay many of these problems.)

A similar concern for continued education and training in reading following the initial short-term program has been expressed by Kent *et al.* (16, pp. 94-95) as a result of their examination of civilian job-related adult basic education programs:

> Available figures indicate that a single ABE program by itself usually accomplishes very little. In most programs the advances which occur in reading, writing, and arithmetic are somewhere around one grade level, or occasionally two grades. Advances in self-confidence may or may not be more substantial—no figures are available. But new self-confidence, even if present, is probably fragile.
>
> So the ABE graduate is unlikely to be in a markedly different employability situation than faced him before ABE. (Note the significance for ABE program goal definition—that program goal statements should refer to making a small start in an important direction, and that programs should be evaluated not so much by the amount of the start as by the realistically usable momentum imparted in the right direction and by their working linkages with post-ABE activities.) Post-ABE help is required to capitalize on these small but important gains. Either the ABE program should have skills-training and job placement or advancement built into it, or (more to the point) ABE should be built into a total employment or advancement program. If the ABE is realistically related to what is going to happen next in work or training, then its results will be reinforced and expanded upon naturally by the new work or training situation.
>
> Evaluation of a well-organized total job-related ABE program will result in recommendations for improvements, perhaps to include additional time with ABE content at later dates (say 3 months, 6 months, or a year after "graduation"). These later sessions might be even more thoroughly integrated with job training than the original sessions were.
>
> Here we are pointing out the importance of a context for ABE which will link it with skills training and work. This context can hardly be supplied by ABE itself, but it could be supplied by skills training or by work or by some combination. Many unions and employers have ongoing training programs, including classroom work and OJT, to which ABE could reasonably be adapted and which could supply this ongoing post-ABE support.

> Also, many schools (adult vocational schools, community colleges, and technical institutes) could (if closely enough related to employment situations) provide support. Any of these types of post-ABE support could also be made a part of the "selling-package" for ABE to increase its motivational attractiveness to students.
>
> ABE is only a beginning, and much more beyond ABE is needed. But for many ABE students, a long-range view is entirely uncustomary. The ABE program should be set up so that it *can* lead on and on, but it may be inadvisable to burden the student with too much thinking about the future. For motivation and symbolically, glimpses of a distant future may help. But detailed learning activities should usually be based on more immediate student interests.

The major conclusions to be drawn from the literature about industry and military based reading training programs are the following:

(1) It appears possible to improve reading skills to a modest degree in about 100 hours in any number of programs.

(2) Programs that relate directly to the students' job interests and involve direct tutoring in the tasks needed to accomplish the job-related reading task appear to be highly motivating; they are also more powerful in attracting and retaining students.

(3) Skills for performing specific job-related reading tasks can be taught in a fairly short time, but this does not mean that the general educational development needed to read and learn from a variety of materials will be much improved.

(4) Follow-on reading training is needed to maintain the impetus achieved in the relatively brief, job-related programs, and to produce literacy skills flexible and extensive enough to enable the students to accomplish a wide range of reading tasks.

(5) The principles involved in applying instructional technology to program development, and the orientation of reading training to the specific job-reading tasks to be encountered by students, seem to underlie any particularly successful literacy training programs in the military or industrial setting. Hence, transportability lies not in the particular program materials, but in the principles behind the programs.

(6) A critical problem for job-related (and all other) ABE is the recruiting and retention of students (the "outreach" problem). We call this the "delivery system" problem—specifically, the problem of getting a program to the intended users and keeping them in it long enough for it to work. This problem frustrates practically all current ABE, manpower, and employability programs. Thus, there is reason to anticipate this as a major problem that will be encountered in any program aimed at providing basic education for employment access and entry for out-of-school, "hard-core" unemployed adults.

SUMMARY AND RESEARCH SUGGESTIONS

This chapter has been concerned with several questions relating to the problem of preparing people with the reading skills needed to pursue studies in career education or job training:

(1) Should lack of reading competence be considered from the "medical model" viewpoint, with emphasis on "remediation"? We argued that this approach should not be used. It fosters the notion that long-established reading problems can be alleviated by a short-term, "shot-in-the-arm" of literacy training, rather than recognizing the need for long-term education and training of the functionally illiterate.

(2) Should interest focus on preparing people to pass credentials requirements or to perform the reading tasks needed for career education programs? We argued that the latter should be the primary goal. Credentials that do not reflect actually needed skills should be challenged through legal action.

(3) Are many people being excluded from career education programs because they lack reading skills? Evidence was adduced from various national surveys and studies to suggest that, indeed, many adults appear to lack reading skills that would be necessary, though not sufficient, to enter employment training programs. Other communication skills, work habits, and attitudes may be equally (or more) important for gaining entry to employment or job training programs. It was further noted that the reading skills needed to do a job may differ from those needed to learn a job in a career education program. We need more conceptualizing and information about career education and job-related reading tasks, and the skills needed to perform these tasks.

(4) Are industrial and military "concentrated" remedial reading programs sufficiently effective to test their use in ongoing career education programs? The answer appears to be that there are no transportable industrial and military programs in the sense of unique materials and/or procedures that could be moved intact to other locations. Most programs either use commercially available materials or materials reflecting the reading (or language) tasks students will encounter in their jobs at the place they will be working. Neither do available data indicate that the "programs" are particularly effective or efficient in promoting growth in general reading skills (one grade level improvement per 90 hours of instruction by a very rough estimate). However, several programs appear to facilitate skill in performing more-or-less job-specific reading and language tasks.

Several conclusions and implications for research and development follow:

(1) Acceptance of the "education/training model" in place of the "medical model" implies a commitment to long-term programs for helping many "hard-core" unemployed people to acquire, maintain, and extend the

difficult comprehension skills needed to use the reading materials in career education programs. There is a need for research to conceptualize and try out programs that can attract and retain such youths for the time needed to upgrade their skills. Job Corps and similar centers provide possible locations for long-term studies.

(2) There appears to be little information regarding the demands for literacy skills in various occupational or career education programs. Research is needed to develop methodologies (see Part I of this volume) for establishing literacy demands of various career education programs, in order to remove unrealistic requirements and accurately match students' skills to career education demands. This may involve the development of special tests of career-oriented literacy and other communication task tests.

(3) Reading skills for learning a job, as in vocational education courses, may differ from the skills needed to do a job, with the former being the more difficult "comprehension" skills. Further analyses and conceptualizations of career-related reading skills and knowledges are needed.

(4) Limited research suggests that employers may be relatively unaware of certain characteristics (such as dialect) that influence their selection of employees. Further research is needed to establish the extent to which nonstandard English usage may restrict access to career education and employment, and to determine whether or not programs for teaching standard English can successfully counter such restrictions.

(5) It appears highly unlikely that industrial and military literacy programs can be transported intact to existing career education programs. Research and development of literacy programs should focus on examining specific career education programs and the type of literacy training best suited to those career education programs.

(6) A major problem in any training program for the hard-to-employ is getting them into the program and keeping them there. Research will be needed on *delivery systems* for recruiting students and maintaining their interest in the programs. In this regard, it will probably be important to depend heavily on the unemployed themselves as indigenous recruiters and program operators, perhaps backed up by R&D organizations that can provide technical advisory services on materials, methods, evaluation, and funding. Complete family rehabilitation, as at the Arizona Job College, where families stay for six to 18 months, may offer inroads to the problem of maintaining attendance. R&D centers with expertise in training and education might be funded to provide support for such endeavors, working as partners to improve the program, rather than as outside evaluators.

Additional Research Suggestions

Although we cannot conceive of a general, total program of research that will solve the problem of low reading skills as a barrier to employment, there are several areas for R&D that should at least minimize the problem:

(1) R&D to make R&D more responsive to particular clients and their needs. It is a frequently noted fact that the major problem in adult basic education is to get people into the program and keep them there. Part of the problem seems to result from the direction of flow for stimulating ABE. This is generally from the federal level, to the state, to the school district and, finally, to the client-student. Research is needed to permit government agencies to function more as brokers between clients who need services and R&D organizations or groups that can provide such services. Clients (people, local school districts, etc.) need a mechanism for making their R&D needs known to government R&D sponsors. The latter in turn need to have input from R&D groups and organizations indicating the kinds of clients they can serve, and in what manner. A procedure is then needed to bring together clients and R&D people.

(2) Teacher training at universities could be changed to include career education, with prospective teachers being exposed to specially developed curricula to teach them about the world of work outside the classroom. This would be particularly important for teachers of adult basic education—who tend to be teachers trained in elementary school teaching with little or no experience with various occupations and their literacy demands. Extending career education to teachers in elementary and secondary schools might serve as a mechanism for preventing lack of career-oriented reading skills in youths, if teachers are taught the nature and importance of such skills and how to develop them.

(3) Curriculum development projects need to be funded that focus on developing functional, work- and career-oriented communication skills for the secondary schools. Today, most high schools teach academic English, not functional communication. Curriculum development efforts are needed that focus on tasks people do in their work (writing technical reports, newspaper reporting, briefing, drafting memos, preparing advertising copy) in addition to analyzing literature and poetry. Many of the materials and procedures developed for such secondary school curricula would be useful for educating out-of-school youth for entry into career education or employment (see Chapter 11).

(4) Basic research studies need to be funded that reveal differences in the information-processing skills and habits of children and adults. Longitudinal studies of "low aptitude" people supported for long periods of time in "learning environments" need to be supported to answer questions such as: "Can the low aptitude disadvantaged learn more complex, academically based professions when they are given sufficient support and

time?" "What methods seem to work best in such cases?" Perhaps a National Laboratory School for Career Education would be a useful place to learn how to assist learning in lower aptitude persons. We need ethnographic studies to determine whether these groups lack certain information-processing skills, or whether they have them but fail to use them in as many situations as higher aptitude persons.

Concluding Comment

The R&D activities discussed herein do not seem to require a linearly sequenced series of R&D property; they can be carried out in parallel. However, the research must extend beyond one year. Hence, it is important to cultivate a positive attitude toward extended R&D activities. Immediate payoffs can be obtained by tightening the linkage between clients and R&D services. They can also be obtained by legal action to ensure that people are not barred from jobs because of discrimination or inflated skill and/or credentials requirements. But it will take time and sustained commitment to devise and carry out educational programs that will provide undereducated adults with the competitive, fundamental skills they need to take advantage of a wide variety of career education opportunities. Our hope is that long-range educational opportunities for out-of-school, undereducated adults will take their place beside the "concentrated" programs of more limited scope—which may provide first steps, but usually fall far short of a completed pathway to optimal career opportunities.

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Chapter 10

A Career Oriented Literacy Training System for the Armed Services

LOW LITERACY LEVELS OF MILITARY VOLUNTEERS

With the advent of the All Volunteer Force (AVF) policy, the military services have entered into competition with civilian businesses and industries for capable manpower. Without the force of the draft behind them, the Services have turned to various incentives and inducements to stimulate American young adults to choose a military career.

With these inducements, manpower has been forthcoming to substantially fill the needs of the AVF. However, a significant proportion of the manpower has come from the lower levels of mental aptitude, as indexed by the Armed Forces Qualification Test. For the period January-March 1972, 17.6% of Navy enlistees were from Mental Category IV, with AFQTs ranging from 10 to 30. During this same period, 18% of Army enlistees were from Mental Category IV, while 8% of Air Force and 21.6% of Marine enlistees were from this Category (1). More recent official figures have not been found, though the New York Times for Friday, February 2, 1973 carried an article stating that "At the start of 1971, the Navy was taking 14 per cent of its recruits from the Mental Level 4 group. By 1973, the ratio rose to 24.9 per cent." The article goes on to report that the Navy was attempting to reduce the numbers of personnel from the lower qualification levels.

As a rough approximation, considering the above data and the fact that Mental Category IV personnel make up some 20% of the population, it seems reasonable to assume that the Services will continue to draw close to 20% of their new enlistees from Mental Category IV.

An indication of the literacy skill levels of Category IV personnel was recently obtained in research sponsored by the Army (Chapter 8). Data from

Based on unpublished manuscripts by Thomas G. Sticht and Richard P. Kern.

pre-Project 100,000, during Project 100,000, and after Project 100,000 indicated that some one-third of Category IV personnel read below grade 7.0, with some 25% reading below the grade 6.0 level. Two-thirds read below the grade 9.0 level, the average reading level for the total Army population.

But Category IV personnel are not the only personnel with low reading skills. Unpublished data by HumRRO indicated that of 661 Army accessions in April 1973, 12% (one out of eight) recruits read below the sixth grade level. Of these 12% who read below the sixth grade level, 35% were Category IV personnel, 60% (almost two-thirds) were Category III personnel, and 5% were Category II personnel. Thus, low reading skill is not restricted to the Category IV recruit.

READING DEMANDS OF JOB-READING MATERIALS

The impact of such reading ability levels on military training and job performance is not known. However, a Navy-sponsored study (2) of the reading difficulty level of training manuals for Stewardsmen, Steward and Cook, Commissarymen, and Firemen, showed reading difficulty levels equivalent to sixth grade, seventh grade, seventh grade, and High School respectively. Thus these materials for four Navy occupational groups with low aptitude requirements would seem to offer some difficulty for many Category IV men. Additional readability analyses in this study indicated that *The Bluejacket's Manual*, a "source of practical information for the seaman," was written (on the average) at the ninth grade level, while certain Navy informational publications—*This is Your Navy*, *All Hands*, *Naval Training Bulletin*—were written at the High School or College level.

A second Navy-sponsored study (3) examined the reading difficulty levels of training manuals in the Aviation Machinist Mates School, Aviation Structural Mechanics School, and Aviation Electronics Technicians School. Results indicated that the bulk of materials for all three schools were written at the 11th-12th grade levels or above, with all of the Electronics Technician materials at the 13th-16th grade level of difficulty.

Apparently, some 20 years later, the results of the foregoing analyses still hold. Carver (4) reports that the average reading grade level of Navy Rate Training Manuals he examined in 1973 was grade 14! Using a formula developed by HumRRO (5) for estimating reading ability level from AFQT, Carver estimated that average reading ability levels of Category I, II, III, and IV personnel were grades 13, 11, 9, and 7, respectively, with ninth grade ability representing the Navy average—far below the difficulty level (grade 14) of Navy manuals. Carver estimated that 51% of Category I personnel could be expected to be able to read and understand Navy rate manuals, while 47% of Category II, 42% of Category III, and 33% of Category IV personnel could handle these manuals adequately.

Mockovak identified "gaps" existing between the reading skill levels of Air Force enlisted personnel and the reading difficulty levels of various job reading materials. Data were reported for students and materials in five technical training courses (6) and for 56 Air Force career ladders.[1]

In general, the approach described by Mockovak for identifying literacy "gaps" involved:

(1) Estimating the reading grade level of materials used in a particular speciality.
(2) Estimating the reading grade level skill of personnel in the particular speciality.
(3) Comparing the reading grade level scores of the personnel to the reading grade level of difficulty of the materials for the particular speciality.

Results of these comparisons showed average reading level of personnel falling below the average reading difficulty level of the printed material in 30 of the 56 career leaders studied.

Similar studies comparing the reading difficulty levels of Army reading materials and reading abilities of personnel (Chapters 2, 8) indicate that the reading level of materials is above grade 11.0, while the average reading ability of personnel is around the ninth grade level.

These data clearly indicate that reading problems of considerable magnitude exist in the Services when reading ability of the men is compared with reading difficulty level of their printed materials. The importance of reading skills in the Air Force is particularly emphasized by the mandatory role successful completion of Career Development Courses (CDCs) plays in determining skill upgrading and career advancement opportunities for the individual. Viewed from this perspective, the literacy "gap" data indicate that a large percentage of men in a given career ladder will be unable to learn readily from CDC materials, they will be unable to make completely effective use of job materials, and they will be less likely to advance in the Air Force unless special actions are taken.

APPROACHES FOR REDUCING JOB-RELATED READING PROBLEMS

Three different approaches can be considered for use in bringing the reading skill level of the personnel and the reading difficulty level of the material within reach of each other:

(1) Lower reading skill requirements by redesigning printed materials to reduce their reading difficulty level.

[1] Results of AFHRL Work Unit 1121-04-05, "Determining the Reading Skills and Requirements of Air Force Career Ladders," briefing memo, 1974, unpublished.

(2) Increase the reading skill levels in the career ladder by raising enlistment standards.
(3) Increase the reading skill level of men in the career ladder by providing training to upgrade their reading skills.

Approach 1—Reducing the Difficulty Level of the Printed Materials

The Air Force has had studies under way investigating the effects of lowering the reading difficulty levels of printed materials used in learning a job. Mockovak (6), in citing these studies, indicates that results to date suggest that lowering the difficulty level of study guides used in instructor-centered training produces no apparent change in student performance. However, lowering the difficulty level of CDCs that individuals use in the field as self-study texts did produce significant differences in student learning.

As these results suggest, lowering the difficulty level of the printed materials is an important step. However, this approach, by itself, can not be expected to "solve" the problem. The extent to which the reading difficulty level of technical materials can be lowered is limited. After a certain point, it becomes necessary to start simplifying and deleting the more demanding job knowledge requirements. The result can be to render a person usable only in a very limited job assignment. To have flexibility, a person must have the fundamental literacy/cognitive skills to adapt to new job demands as they occur.

Approach 2—Raising the Reading Skill Requirements for Entry Into a Career Ladder by Limiting Assignments of Low Readers

The application of this approach is illustrated by consideration of two primary recommendations regarding the training of Mental Category IV personnel presented in a review of some five years of study by the Naval Personnel and Training Research Laboratory (7, p. 8):

> 1. Do not assign Group IV personnel to Navy ratings that have high verbal, computational, or conceptual requirements. (The storekeeper rating is an example.)
>
> 2. In general, training programs should minimize reading requirements (including written tests) and theoretical knowledge and should utilize pictorial materials, simplified terminology, and practical illustrations. The actual performance of job skills should be stressed.

The Navy laboratories are not alone in their conclusions regarding the advisability of using reading materials for training Category IVs. In a report

of an extensive series of studies on the development of training techniques for use with Category IV personnel, Army research concluded (8, p. viii):

> For the low aptitude groups, printed programs or programmed texts were the least effective technique. On the basis of this study we conclude that written material as the primary medium should be used with low Category IV personnel only as a final recourse.

It would appear, then, that a major strategy recommended for contending with the literacy deficiencies of many military personnel is to avoid the challenging job of improving personal competencies, resorting instead to limited areas of assignment and elimination of reading demands from training programs.

While there can be no denying that such strategies work in the short run—that is, Category IV men can be trained in motor skills using "hands-on" methods and utilized in less demanding occupations—there is reason to question the long-term value of the strategy of limited assignments and nonverbal training, both from the Service's perspective and that of the trainees. For one thing, though reading materials can be eliminated from training programs, it is doubtful that they can be removed from on-the-job use. The reason is that printed materials serve as repositories of needed facts (e.g., standards and specifications, procedural directions), which, if not accessible by means of reading skills, must be memorized in training. Since equipment and procedures may change *after* a man has completed training, it would prove very expensive to redesign a training program to provide nonreading, hands-on training every time such changes occur. A primary function of print is, in fact, to replace the need for direct, hands-on, personalized instruction, thus expanding the individual's range of utilization.

With regard to career development, it seems to us that the strategy of avoiding the use of printed materials, starting early in a man's career, may foretell a limited level of achievement later on when actual job demands call for greater use of reading materials. That higher level jobs *do* demand more reading is suggested by a Department of the Army (9) survey of the primary reasons for reading among Army officers and enlisted men. For enlisted men, the percentage of job-related reading gradually increased from 2% for E-1s, to 25% for E-8s, and then dropped to 16% for E-9s. Thus, higher levels of pay and responsibility seem to require a greater amount of reading. To assign personnel to nonreading "tracks" at the start of their careers is to place a definite limitation on their career development and restrict their range of utility (say, through cross-training or re-training as new jobs open up) to the Services.

The strategy of avoidance of reading also seems unwise in view of the emphasis upon educational opportunities as inducements to enlist in the Services. In two separate surveys (May 1971 and November 1971), it was found that "*a fully paid college education* was the most preferred enlistment incentive in both surveys." Though somewhat less appealing to respondents

from families with annual incomes below $8,000, the incentive value of education and training was expressed strongly by the appearance in both surveys of *learning a skill or trade valuable in civilian life* as an inducement to enlistment.[1] It seems reasonable to assume that most *valued* civilian trades will involve the use of reading. This is strongly suggested by the nature of jobs service personnel report that they expect to have after their military service. For a sample of 718 Navy personnel at San Diego in March-June 1971, HumRRO researchers (10) found that the most frequently mentioned occupational areas men expected to work in after their Navy duty were: professional, technical and managerial (one category), machine trades, and structural (construction work, welding and frame cutting, electrical assembly, installation and repair).

It appears to us that, because of its potential negative impact upon (a) inducements for enlistment (recruitment), (b) personal career development (job satisfaction and the individual's word-of-mouth promotion of career opportunities in the Services), and (c) the Services' ability to enlarge the base of technically *competent* men, the strategy of avoiding reading in job training and assigning Category IV personnel to jobs having limited reading and other cognitive requirements is not in the best *long-term* interests of the military.

Approach 3—Literacy Training as an Alternative to Limited Training and Job Assignments for Mental Category IV Personnel

A positive alternative to the strategy of limiting the use of reading materials in training programs and assigning marginally literate personnel to less cognitively demanding jobs is a serious commitment to upgrading the basic cognitive and literacy skills of such personnel.

Literacy Training in the Navy. In recognition of the reading deficiencies found with some personnel, the Navy provides a measure of remedial literacy training. The following description of the Navy literacy training program and its accomplishments is from the December 1969 report on Project 100,000 prepared by the Office of the Secretary of Defense—Assistant Secretary of Defense (M&RA) (11, p.45):

> *Navy* has had a Remedial Literacy Training (RLT) program since January 1967. The length of the training and the entrance requirements have varied during its existence; however, it is currently a 4-week program with provision for holding some men longer if necessary. The entrants are those men who are having difficulty in basic training because of poor reading ability. No fixed grade level goals are established for graduation from RLT.

[1] Reported by Allan H. Fisher, Jr., Human Resources Research Organization, on the basis of a civilian youth survey conducted for the Department of Defense in 1971.

They also receive military training and are returned to regular basic training after leaving RLT. The current entry rate is about 120 per month, mostly New Standards men.

The accomplishments of Navy RLT are described in the OASD/M&RA report (see Table 45). As indicated in the table, men graduated from RLT reading in the range from grade 5.0 to 5.5 following an average of 144 hours of reading instruction. *If* the readability studies cited earlier are reasonably accurate indicators of the difficulty of present day printed materials in Navy training programs, and *if* the Navy's remedial literacy training program is currently graduating personnel who have, on the average, fifth grade reading ability, then it would appear that a considerable gap might still exist between the reading skills of many personnel and the reading demands of several of the Navy's training courses.

Current Reading Improvement Instruction in the Air Force. The Air Force offers reading improvement instruction to airmen scoring below certain screening test criteria at two different stages of the training process: preceding basic training and following duty assignment to the field. The

Table 45

Navy Remedial Literacy Training (RLT): January 1967 - September 1969

Group	Number
Total Entered RLT	2,385
Less Those Still in RLT	203
Less Losses (discharged from Service for unsuitability or for medical reasons)	163
Total Completed RLT	2,019
Experience With Those Who Completed RLT	
Successful Completions (returned to regular basic training)	1,714
Failed to progress (most subsequently discharged from Service)	305
Total	2,019
Reading Grade Level of Graduates	5.0 - 5.5
Average Hours Reading Instruction per Student	144

programs at these two stages of training are completely independent of one another.

During processing at Lackland Air Force Base, new recruits classified in Mental Category IV are administered a reading screening test. Those who score below the sixth-grade level are assigned to Reading Proficiency Units. Once assigned to these units, they attend classes in reading instruction for four hours a day for a period of up to 13 weeks. The individual completes this instruction when he demonstrates tested reading ability at the sixth RGL, or at the end of 13 weeks, whichever comes first. He is then sent on to Basic Training. This reading instruction is oriented toward improving the airman's general, as opposed to job-related, reading skills.

After completing Basic Training, the airman may or may not be sent to a resident course of instruction. In either event, his next assignment will be to a job in the field. With this assignment, he also enters the OJT system. At this time airmen who have an AQE General or ACB score of less than 50 are given a reading achievement screening test. Under the criteria contained in Air Force Manual 50-23 (12), those airmen who score below the ninth grade level (USAFI Achievement Test III) are enrolled in a reading improvement course concurrent with their job assignment and OJT. OJT supervisors may also refer an airman who they feel is having difficulties to the base education office for testing, and, if appropriate, enrollment in the program.

The reading improvement programs conducted for personnel at the base level are the responsibility of the base education office. A recent Air Force survey of these programs has been reported by Mockovak (13). The results show the usual limitations on interpretations of mail questionnaire information supplied at varying levels of completeness; however, they do provide a basis for constructing an initial composite description of how reading improvement efforts are being carried out in the field, together with major characteristics of the students one might expect to find enrolled.

Ninety percent of the 84 responding bases had reading improvement programs with a combined enrollment of 5,774 men during the period from April 1972 to April 1973.

The majority of the base reading improvement programs were arranged and taught by local colleges (43%) and high schools (25%). For the remainder, 28% were arranged and taught by independent contract personnel; only 4% were taught by Air Force personnel. Presumably, the extensive use of local colleges and high schools was related to funding arrangements. Almost one-half (49%) of the programs were funded by the Veterans Administration, while 13% were paid for by the local school districts using state and federal funds. The remaining 38% were financed by the base education offices. Cost per student in the VA-financed programs ranged from $20 to $552 per student (median cost, $187.50). The range in

cost per student for the Air Force-financed programs was $19 to $50 per student (average cost, $26). Entry into the program was generally (83% of the bases) based on the criteria of a RGL of the ninth grade or less, as specified in AFM 50-23 (12); however, there was a somewhat wider variation in choice of the screening test used to identify men for enrollment.

AQE data were supplied for only 367 students. Estimates of average RGL based on AQE General scores for these students suggest entry level reading skills of about 8.5 RGL.

Criteria for successful completion of the program were frequently not explicit and appeared to vary considerably from base to base. Time in the program varied from an estimate of 24 classroom hours to 240 hours, with an overall average of 76 hours. In general, most bases (83%) identified achievement level goals of their programs at the ninth RGL; however, some (11%) had higher goals, while only one of the 84 bases had a goal of less than the ninth RGL.

The most common type of reading problem cited (55%) was the student's inability to read, comprehend, and pass his CDC material; problems cited less frequently were a lack of basic reading skills (28%), and English as a second language (11%). There was a tremendous variation in the educational background of students from base to base, with the proportion of non-high school graduates ranging from 5 to 100% of the student enrollment. Overall, non-high school graduates averaged 50% of the student enrollment. The majority (62%) of the students were apparently in their initial job assignment; however, another 25% were training for an advanced skill level.

Literacy Training and Literacy Demands of Military Jobs. As indicated earlier, the Navy and Air Force[1] presently provide remedial literacy training (RLT) for men whose difficulty in basic military training is judged to result from reading skills that are not sufficient for accomplishing the reading tasks encountered in BMT. Whether the reading skill levels achieved by such reading training actually aid in the subsequent accomplishment of BMT is not known; but the limited available evidence regarding the reading difficulty levels of training manuals, presented earlier, suggests that the fifth and sixth grade levels of achievement, which are the objectives of these programs, are insufficient for effective use of the job training manuals.

Other than the readability studies mentioned earlier, no information has been found about the literacy demands of various Navy and Air Force jobs. However, HumRRO conducted an extensive study for the Army about the reading demands of four jobs: Cook, Mechanic, Armor Crewman, and Supply Clerk (Part I). A variety of methods were used, including readability analyses of job reading materials; direct measurement of the ability of personnel of various *general* reading ability levels to read

[1] Army literacy training is discussed in Part II, Chapter 8.

and complete job reading task tests constructed of actual job reading materials; determinations of correlations between reading ability and performance on the Army's job proficiency tests, and on job knowledge and job performance (4-5 hour, "hands-on," work sample) tests.

The conclusion drawn from these various analyses was that the Cook's job had the least literacy demands. Accordingly, if remedial literacy training was planned for personnel programmed to become Cooks, the minimal targeted level for RLT should be grade 7.0. For Mechanics and Armor Crewmen, targeted literacy training levels should be grade 8.0, while grade 9.0 should be the lowest targeted level of literacy training for Supply Clerk personnel.

Though similar work has not been found for the other Services, it seems reasonable to assume that comparable jobs in the remaining Services would require at least comparable minimal levels of literacy—levels far exceeding the fifth and sixth grade levels that formed the literacy training objectives of the entry level remedial literacy training programs during 1967-69.

The challenge to the Services is to overcome the temptation to provide "instant literacy" by means of brief, "one-shot," literacy training programs (see Chapter 9). Such programs may provide a modicum of practice and, by a spurt of effort, permit the achievement of sufficient raw scores on a standardized test to claim a year or two of "growth" in literacy. However, such "growth" must be viewed as the *start* of the development of competency in the literacy skills; continued growth must be nourished by a sustained program of literacy training aimed at rendering a man fully capable of achievement in his career.

While it is true that all Services *do* provide access to literacy training programs beyond the entry-level program, as indicated in Mockovak's work in the Air Force, these programs do not satisfy the need. Drawing on his survey information, Mockovak concluded that: (a) significant numbers of Air Force personnel need and are enrolled in reading improvement programs at the base level; (b) the Air Force currently lacks a systematic, systems-oriented approach for dealing with these reading problems. Each base has its own program, resulting in a "myriad of approaches, varying course lengths, different definitions of successful student performance, diverse financing and teaching methods, and inadequate records concerning student problems, personnel data, and progress."

In addition, Mockovak questioned the extent to which improvement in job-related reading can be expected from programs geared to develop reading skills in the context of *general* educational development. The most common reading problem complaint centered on the difficulty the individual had in comprehending and successfully completing his CDC

materials. Individuals enrolled in the reading improvement programs tend to be those with reading skills averaging slightly below the ninth grade level.

Thus, even if the GED program raises reading skills to the ninth grade level (the objective for current programs), the student is still faced with the problem of learning the specific vocabulary and concepts contained in his CDC materials before he can perform at his new, improved general reading level with the CDC materials. Since the CDC materials are used in what is essentially a "home study" context, the amount of vocabulary and concept learning required would be expected to strain his motivation to continue almost as much as if he had approached the CDC materials without the general reading instruction.

Although stated within the context of an Air Force study, such conclusions appear applicable to all the Services. Each Service has extensive home-study, correspondence and other materials presented in advanced, residence-training programs that pose considerable literacy problems for personnel seeking career advancement. It is unlikely that the limited entry level, remedial reading programs, targeted as they are to the fifth or sixth grade level, will permit personnel to contend adequately with the reading requirements for *entry* level job positions, much less for *higher* level positions. Furthermore, for the reasons cited by Mockovak, it seems unlikely that existing GED programs can produce the growth in literacy skills at the rate and of the type needed to enable a person to contend adequately with the advanced reading requirements of his job.

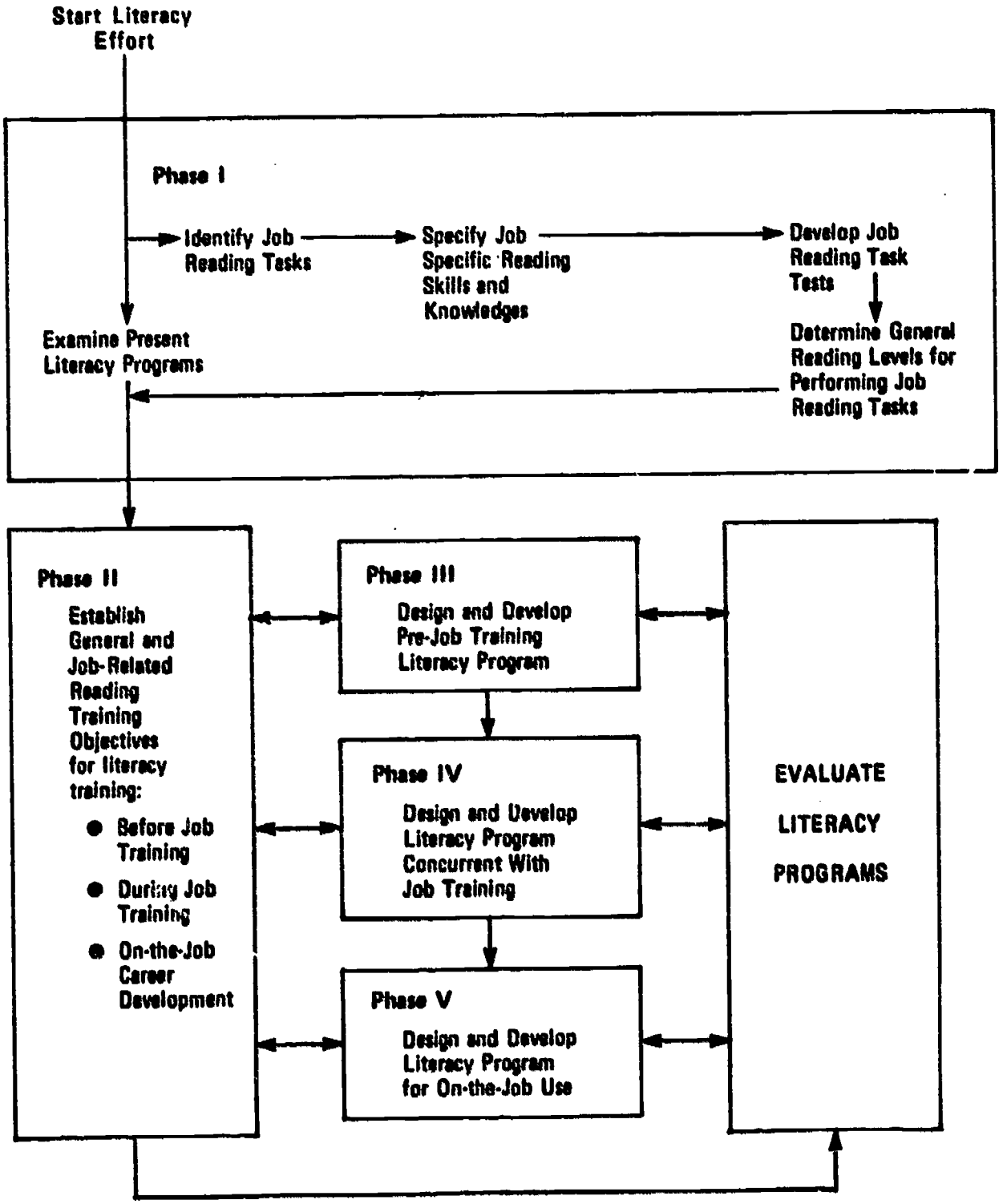
A CAREER-ORIENTED LITERACY TRAINING SYSTEM FOR THE SERVICES

Because of the limitations in the Air Force's current GED literacy programs, Mockovak recommended that the Air Force develop a job-related reading program that would systematically relate to job reading demands. In other words, what is needed is a comprehensive literacy training system (Figure 44) for military personnel that will (a) systematically relate to job reading demands and career development, and (b) provide a job-functional context for the teaching of skills and knowledges needed to successfully accomplish job reading tasks at the highest rung of the career ladder.

Conceptually and procedurally, such a program would recognize that many marginally literate personnel reject traditional school-referenced education programs, especially language arts (reading, writing, spelling, literature). They do, however, respond more favorably to the "language arts" when these are couched within the context of job-related reading (14; Chapter 9). For this reason the orientation should be toward the design of a literacy system in which the training of literacy skills is *functionally integrated* with the training of military and job skills and knowledges.

Figure 44

A Career-Oriented Literacy Training System for the Armed Services



The complete design, development, and evaluation of a career-oriented literacy training system is a large undertaking, requiring considerable time, money, manpower, and facilities. It is important, therefore, that the R&D work proceed systematically according to a carefully prepared design. This design must permit the achievement of the ultimate goals of the R&D program within the constraints of the Services as operational systems. It is necessary, therefore, that the first phase (see Figure 44) of the R&D effort be devoted to a thorough analysis of the current status of the Services' literacy problems and to the development of a management plan that will produce a literacy training subsystem that will *work* in the operational context of the total military training and career-development system.

Thus, the outcome of the Phase I activities in Figure 44 should be *a "blueprint" for military training management to use in developing a comprehensive, career-oriented literacy training subsystem compatible with the Services' large training and career-development systems.* This "blueprint" for literacy training should include:

(1) Information about the current training pipeline and career-development programs and how these programs link to the current literacy and GED programs.

(2) Information about the general reading ability of personnel entering the Services compared with the reading requirements of basic military training (BMT), job training, and jobs into which large numbers of lower aptitude men are likely to be assigned.

(3) Information about the nature of the reading tasks encountered in BMT, job training programs, and jobs, and the levels of general literacy skills needed to perform these tasks.

The "blueprint" for a literacy training system should be oriented not only to functionally illiterate *entry* level personnel, but also to more advanced, but not highly literate, personnel. Thus, Figure 44 includes three levels of literacy training: the Phase III level, for new recruits; the Phase IV level, in which literacy training and job training would be given concurrently; and the Phase V level, which provides for continuing career-oriented literacy training for personnel who are on the job. Such training should prepare personnel with the advanced literacy skills needed to assume higher levels of responsibility in their military careers.

With such a comprehensive career-education program, which integrates job skills and literacy skills training, a larger number of personnel should find greater opportunities for a *career*, not just a job, in the Armed Services.

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Chapter 11

Needed: A Functional Literacy Curriculum for the Secondary School

Though it is not certain why, it is certainly the case that we frequently create a topsy-turvy world for ourselves. Nowhere is this more clearly illustrated than in the contrast between our teaching of reading and writing in the schools and the kinds of reading and writing done in the world outside the school.

A newsletter from Educational Testing Service (1) reports the results of a national survey to determine, among other things, what the average American adult reads in one day and how long he spends reading it. Results indicated that more people (42%) spent more time (61 minutes a day) at work-related reading than any other type of reading. Newspaper reading occupied the most people (74%), but they spent considerably less time (35 minutes a day) at this type of reading.

Yet, while functional work-oriented reading is the primary reading activity of out-of-school adults, secondary schools typically allocate the overwhelming majority of their time to teaching the reading and interpreting of novels, short stories, dramas, and poetry.

And if the teaching of functional reading is short-changed in the secondary school English curriculum, how about the teaching of functional writing—for example, the writing of job manuals, instructions, procedural directions and other technical writing?

Dolores Landreman (2), technical writer for Battelle Memorial Institute, and former high school English teacher summarizes the problem:

> . . . if articles published in the *English Journal* can be considered indicative of the major interests of American high school English teachers, these teachers apparently feel no great responsibility for grappling seriously with the specific problem of improving scientific and technical communication . . . They also appear to be much concerned with the expectations of college English faculties. The possible needs of the ultimate consumers—the eventual employers of their students—do not seem to have been given the intensive investigation one might expect . . . Technical communication apparently is not conceived of as a proper area of student interest.

Based on unpublished manuscript by Thomas G. Sticht.

Though technical writing forms the bulk of the reading materials for working adults, students are typically not taught such writing in the secondary schools. Technical writing is generally taught in colleges or technical institutes, but there is reason to question the adequacy of this instruction. For instance, though technical writers are repeatedly admonished to "define your reader," to ask themselves "what is his reading level?" and so forth, they frequently are far off the mark. Caylor, *et al.* (3), using a special readability formula that they developed to estimate the reading grade level of difficulty of job manuals, found that more than half the reading materials in seven U.S. Army career fields were of 11 to 12+ grade level in difficulty. These procedures were extended by the U.S. Army in a study of more than 400 technical manuals, with the same finding--most of the manuals were written at a level well above the ninth grade reading level of the average soldier.

But the manual writers are not alone in overshooting their mark. Barganz and Dulin (4, p. 29) reported readability levels of lead articles in several magazines—*Reader's Digest*, *Saturday Evening Post*, *Popular Mechanics*, *Ladies Home Journal*, and *Harper's*—and found them to be, on the average, of 12-13th grade level of difficulty; and they were that way over a 40-year period! Newspaper journalists fared somewhat better in a study by Razik (5), in which he found that news articles concerning crime, features, local news, weather, and national political news were written at the 9-10th grade level. Stories relating to economy, space, international news, and state and national nonpolitical news were written at the 11-12th grade level. Small wonder that dramatic increases in the reading of newspapers and magazines are found among the more highly educated—professional/managerial—higher income groups (6, p. 197).

We can go on: The National Reading Council's Survival Literacy Study (7) indicated that many U.S. Government public forms were too difficult for 18.5 million American adults; the National Assessment of Educational Progress (8) found that, of adults asked to write a letter ordering a product, acceptable responses were obtained in only 49% of the samples; only 57% of adults wrote adequate directions for making or doing something; fewer than 30% of men reading at the ninth grade level scored 70% on a job reading task test for supply clerks in a study by Sticht *et al.* (9).

But there is no need to go on—the evidence is overwhelming in indicating that many adults, young or older, cannot read and use with facility much of the written materials needed to function well in our society. On the other hand, the evidence just as strongly indicates that the majority of those who prepare written materials to serve functional purposes fail to match the literacy skills of many of their intended readers.

Apparently, those responsible for teaching reading at the secondary school level are usually English teachers, and they teach reading and

interpretation of literature. Their teaching of writing is almost solely restricted to composition. They are typically *not* extensively (if at all) trained in teaching reading and writing of a functional nature: technical writing and editing, journalism (news gathering and reporting), copy writing (advertising), business writing and reading (forms construction, memoranda), and integrated use of writing and graphic designs.

Likewise the instruction of persons involved in the various areas of functional writing cited reflects only the most informal understanding of the reading process and the cognitive processes that their writing demands of the reader. Examination of books written to teach technical writing, for instance, shows some knowledge of readability formulas, and admonitions to write clearly and concisely and to keep the reader's needs in mind. Beyond this, however, there is little understanding of the role of such cognitive processes as short-term memory, or perceptual processes such as the "chunking" of information, or behavioristic concepts such as cue-response paradigms, to provide the technical writer with empirically founded heuristics for writing for readers.

It appears, then, that there is presently a separation between those who teach reading and those who, outside the school, produce the written materials that school graduates and in-school students must read to function outside the school. Those who write newspapers typically do not teach reading of newspapers; those who write job technical manuals do not teach the reading of such manuals; those who write advertising copy do not teach the reading of such copy; those who produce job aids in the form of various guidebooks, flow charts, picture books, and so forth, do not teach how to read such aids. Persons who write various government pamphlets and booklets do not teach how to read those materials.

On the other hand, those who teach reading in English courses rarely write job aids, technical manuals, advertising copy, newspapers, government pamphlets, or the other functional reading materials encountered outside the school.

The lack of communication between these two groups, that is, functional writers and teachers of reading, may account, at least in part, for the breakdowns in the communication of functional information to the general public.

Bridge-building efforts are needed to span the gaps presently separating the functional writing disciplines from the field of English-reading instruction. Such efforts should stimulate current members of these disciplines to view their work as interrelated, and forge an interdisciplinary approach to a technology of communicating by written text; they should also provide redirection for priorities and practices in English teaching at the secondary level. This redirection should be away from a

primary focus on teaching academic English to produce more English academicians, and toward teaching functional literacy to produce functional readers and writers—young adults with work-relevant literacy skills and knowledges that improve their *employability* as well as their schoolability.

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