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ABSTRACT

As part of a project that identified the specific literacy skills required in ten occupations, this report provides two levels of instructional information about electricians. Factual data are presented in Parts I and II for use in decision making by program developers, administrators, teachers, and counselors. These sections note the specific literacy requirements (reading, writing, listening, speaking, and mathematics) that were identified at three job sites and in three vocational training programs. Part III presents instructional methods/materials that adult basic education teachers can use to develop literacy skills while imparting job related knowledge. The lesson format is based on a directed reading activity and includes vocabulary and concept development, sentence and organizational structure, silent reading, and skill development. Appendixes list the technical vocabulary that electricians need to know, the 100 words that represent 45% of the language sampled for the entire project, and occupational literacy requirements for the ten occupations that were studied. (AEA)

THE LITERACY REQUIREMENTS OF AN ELECTRICIAN ON THE JOB AND IN A VOCATIONAL TRAINING PROGRAM

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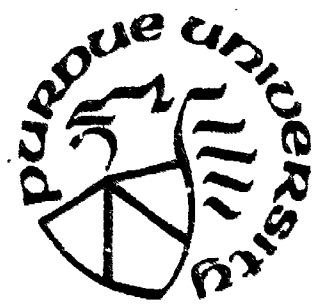

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* * *

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PROJECT ABSTRACT

THE IDENTIFICATION OF LITERACY REQUIREMENTS OF JOBS IN INDUSTRY AND CORRESPONDING VOCATIONAL TRAINING PROGRAMS

1.	Need Addressed:	Meeting the educational needs of adults with minimal literacy skills who wish to enter skilled or semi-skilled occupations.
2.	Population Served:	Adults with minimal literacy skills.
3.	Brief Description:	Specific literacy requirements (reading, writing, listening, speaking, and mathematics) of semi-skilled and skilled occupations in business, industry and vocational training programs were determined. The literacy demands of three work contexts and training programs for each of the ten occupations were then analyzed and reported.
4.	Major Objectives:	To provide educators, counselors, and administrators with a description of the literacy requirements of semi-skilled and skilled occupations and training programs to which functionally illiterate adults aspire.
5.	Products:	A description of the literacy requirements necessary to hold a job in each of ten occupations and the corresponding requirements necessary to succeed in vocational training programs which prepare individuals for each of those occupations is provided. A booklet for each of the ten jobs was prepared.

INTRODUCTION

This project was undertaken in response to a need, expressed by adult basic educators and counselors, for information about the specific literacy skills necessary for success in several occupations. The occupations studied had been identified as desirable careers during informal interviews with adults who were enrolled in basic education programs in the Lafayette, Indiana area. Employment counselors and officials of the Office of Career Development confirmed that the occupations identified for study were appropriate. Because Greater Lafayette offers a wide range of occupational and training opportunities, the project staff was able to study both job sites and vocational training sites for each of the following occupations: account clerk, automotive mechanic, draftsman, electrician, heating and air conditioning mechanic, industrial maintenance mechanic, licensed practical nurse, machine tool operator, secretary, and welder.

Purpose and Audience

This report provides descriptive and instructional information to adult educators at two levels. Factual data are presented in Parts I and II for use in decision making by program developers, administrators, lead teachers, and counselors. Part III presents instructional methods and materials and is meant for use by adult basic education teachers. Members of both groups may be interested in the entire report, but in preparing it the project staff attempted to address the needs of the two audiences separately.

Procedures

To identify reading, writing, speaking, listening, mathematics, and other characteristics which are necessary for success both on the job and in the training program, three job sites and three vocational college courses were studied.

Required reading materials from each of the six settings were evaluated using two widely used readability formulas, the Dale-Chall Formula and the Fry Readability Graph. Readability estimates were computer assisted. A minimum 2000 word sample of written language was taken from each site. Special considerations and problems related to reading the technical materials were identified, and the relative use of reading as a work tool and as a learning tool was determined.

To identify speaking and listening requirements, one hour samples of oral language were recorded at each job site and in each vocational college course. Language recorded at each site was rated for its technical and formal qualities, and computer-analyzed to assess vocabulary and syntax. Written and oral language samples were used to develop the Key Technical Vocabulary List found in Appendix A. The combined language samples from all occupations studied were used to develop the Highest Frequency Word List found in Appendix B. A summary of the literacy requirements for all ten occupations studied is found in Appendix C.

Writing samples were obtained at each of the six sites and used to determine the nature of written communication demands on the job and in the vocational training program.

Mathematics demands were determined through surveys of materials from the job sites and classrooms. Instructors and supervisors responded to a questionnaire about the specific mathematics skills necessary for job and/or training program success.

Important non-literacy characteristics were identified by supervisors who completed a rating scale which asked for their estimate of the importance to job success of such factors as cooperativeness, reliability, and attitude toward work.

The following sections of this report are organized according to the requirements of the job, the requirements of the training program, and instructional recommendations.

PART I

REQUIREMENTS ON THE JOB

Job Sites Studied

At each of three separate job sites the literacy demands placed on one successful electrician were studied. Reading, writing, oral language and mathematics were the specific literacy skill areas examined. The roles of the workers studied were similar; each was involved with the installation and wiring of new equipment. Two electricians were concerned mainly with new building construction. The third worker was involved with the installation of heavy equipment in a factory which was being renovated. From each job site, representative samples of the reading, writing, and mathematics tasks done on the job were obtained. Samples of oral language requirements were obtained by recording a randomly selected one-hour period of on-the-job verbal interaction. At each job site, the electricians' immediate supervisor completed a questionnaire which asked about the importance of eleven worker characteristics. Supervisors were also asked to identify the mathematics skills necessary for job success and to estimate the amount of time per week the workers spent using mathematics and reading skills.

Reading Requirements

Persons succeeding as electricians need highly developed reading skills. Supervisors stated that reading was necessary about ten to twenty-five percent of the time, but the difficulty level of the required material was very high. Reading materials from the job sites included electrical code books, building specifications manuals, engineering handbooks, reference books commonly used in electrical occupations, and blueprints and schematic diagrams. The required reading materials involved sentence/paragraph format as well as tables, charts, and other graphic means of presenting information.

The style of writing encountered in most of the materials studied was highly technical. Handwritten messages which passed between workers and supervisors were less technical than other materials, yet they contained highly specialized words and concepts. Example I illustrates the technical language encountered at two of the electrician job sites studied.

EXAMPLE I

Electrician Reading Requirements

A. Installation Instructions

"Load Connections: B/W relays are two-wire control devices having load contacts rated at 1 hp., single phase, 110 or 220 volts AC--or standard duty pilot rating up to 600 volts AC. In operation, these load contacts merely act as a switch to open or close a circuit. Connecting them to an external load does not introduce a source of alternating current into the circuit.

Accordingly, in making connections for direct current operation of single-phase loads within rated capacity of relay, power connections must be made as shown in relay wiring diagram." (B/W Controls, 1977, p. 2)

B. Contract Specifications

"Work required for installation of Electrical Rough-in in precast concrete slabs.

1. In general the Electrical Contractor shall:
   a. Provide all layout of holes through the precast concrete slabs to the General Contractor for approval by the precaster.
   b. Core drill through the voids in the precast slabs for installation of conduits and boxes.
   c. Conceal all conduits for lighting, outlets, etc., in the fill above the precast concrete slabs."
   (Scholer, 1977, p. 16028-1)

The difficulty of the required reading materials was estimated by computer analysis using the Dale-Chall Formula and the Fry Readability Graph. Because several materials were examined at each job site, and because of variation in the estimates made by the two methods, Table I presents readability levels in ranges of difficulty.

TABLE I

Readability Estimates for On-The-Job Materials

Job Site One	College to college graduate level
Job Site Two	College to college graduate level
Job Site Three	College graduate level

Readability formulas do not take into account factors such as reader motivation or familiarity with difficult concepts and unusual vocabulary. It is likely, therefore, that persons performing successfully as electricians and who could read required electrical materials without difficulty would have had difficulty with high readability level materials from unfamiliar areas of specialization. In fact, military studies

suggest that experienced workers were able to successfully use familiar materials several levels higher than their measured reading abilities should have allowed (Sticht, 1975). The implications of this research for ABE instruction are discussed in Part III of this report.

Special Reading Considerations and Problems

The predominant style of writing encountered in on-the-job reading materials was technical, as illustrated in Example I. Electricians who participated in the study reported that much of the reading that they did involved finding important information in texts and tables of figures. Specifications documents, electrical code handbooks, blueprints and instructions sheets were the most frequently used materials. Careful reading of instructions sheets was cited as critical by one worker who stated that costly damage to materials could result if he misread instructions and incorrectly connected wires.

Another indication of the importance of thorough, careful reading was found in the response of a worker when asked if reading required materials incorrectly would affect him or his work. His response was, "Yes, it would mean the conduit would go the wrong way or the wrong amount of wire would be pulled."

In addition to the textual format presented in Example I, handbooks presented information in the form of tables. Example II shows a table information format frequently referred to by electricians in their work.

EXAMPLE II

DEVICES, PLATES AND CORDS

VOLTAGE	NEMA	AMPACITY	CORD #	OUTLET	CAP	
125 1φ	5-15	0 - 15	3/C #14	5261	5266	
	5-20	15 - 20	3/C #12	5361	5360	
	5-30	20 - 30	3/C #10	9308	9309	
	5-50	30 - 50	3/C #6	9360	9362	

(Scholer, 1977, p. 16140-3)

Materials which presented information in the above format clearly illustrated the need for specialized job-related knowledge and well-developed skill in obtaining information from printed materials.

Uses of Reading on the Job

From the worker-completed questionnaire, it was concluded that most of the reading required of the electricians who participated in the study was done to obtain important information. The workers indicated that in most cases it was not necessary to remember the information for more than a day. It was also remarked by the workers that key information would be looked up again rather than entrusted to memory. Pocket sized handbooks were kept for quick reference to wire and conduit specifications. Thus, reading was used very frequently to find and check data. Estimates of time spent in using reading on the job ranged from three hours to ten hours per week. In every case, it was stated that incorrect reading of

required materials would lead to costly mistakes affecting the worker and others as well.

Although reading was used primarily to accomplish work with little need for learning the information obtained, the use of trade reference books required reading to be employed as a learning tool. Information obtained from reference books usually concerned theoretical and operational data about particular types of electrical equipment. Such information was memorized and integrated into the working knowledge of the electrician with only an occasional need for review.

Writing Requirements

The writing requirements of the electrician were typical of most of the ten occupations studied. In general, the use of standard "grammatical" English sentence structure was not required. Messages and notes, for example, were written in informal, economical style; only words that were essential appeared on written communications and sketches.

Legibility was unimportant except when it interfered with communication. Memoranda were written with varying degrees of legibility.

Mathematics Requirements

The mathematics demands of the jobs studied were high. Supervisors' responses to a questionnaire about the use of mathematics on the job revealed that, at each job site, mastery of mathematics skills including geometry, algebra, and trigonometry was required. The amount of work time spent on mathematics-related activities, according to supervisors' estimates, ranged from three to thirty hours per week. Mathematics was used more frequently than reading in accomplishing work. In comparing

the importance of mathematics skills to the importance of reading skills, two supervisors rated them both to be very important. The remaining supervisor rated mathematics skills to be very important, while rating reading skills to be of average importance to job success.

Example III contains a mathematics problem found at an electrical job site.

EXAMPLE III

On-The-Job Electrical Mathematics Problem

"Ampacities at ambient temperatures other than shown in the tables shall be determined by means of the following formula:

$$I_2 = I_1 \frac{TC-TA_2—DELTA\ TD}{TC-TA_1—DELTA\ TD}$$

Where,

I_1 = Ampacity from tables at TA_1

I_2 = Ampacity at desired ambient TA_2

TC = Conductor temperature in degrees C

TA_1 = Surrounding ambient from tables in degrees C

TA_2 = Desired ambient in degrees C

DELTA TD = Dielectric loss temperature rise"

(National Electrical Contractors Assn., 1978)

A survey of electrical on-the-job mathematics materials, of which the above is a representative sample, indicated that fairly sophisticated mathematics skills were important to job success.

Oral Language Requirements

Oral language recorded at the job sites combined informal styles of

speech with job-related, technical concepts and vocabulary. Conversation much of the time was not job-related, but frequently it focused on aspects of job-tasks that were being performed. Giving and following verbal directions and clear statements of problems were important abilities noted on the tape recordings. Much job-related conversation involved verbal instructions such as that shown in Example IV.

EXAMPLE IV

On-The-Job Verbal Interaction

Electrician: "Okay, you better bring that 110 volt circuit this way. We'll take the door as a variation of a quarter..."

Co-worker: "We're gonna have to get those three doors in there. Let me show you."

Electrician: "We'll go ahead and go on out and lay out the--I'm gonna use that, use your chalk line then and lay out the center of the hallway, of the room, and then just, just lay them out that way."

Co-worker: "I'll tell you this then, the fixtures are running north and south and the knockouts are right down the center of the fixtures."

Interaction, such as the above, was often accompanied by meaningful gestures and sketches which aided comprehension.

Key Non-Literacy Requirements

Supervisory personnel rated several worker characteristics according to their importance to overall job success. The following characteristics were rated as very important by all of the supervisors:

Ability to work cooperatively with others

Positive attitude toward work

Ability to communicate through speaking

Ability to follow spoken directions

Ability to read blueprints

In addition to rating the above qualities, the supervisors added that alertness, mechanical skill, trustworthiness, record keeping skills, and ability to work under different working conditions were also very important.

An interesting result of the rating scale is that all of the qualities listed above were rated to be at least as important as reading and mathematics abilities. One supervisor rated reading, writing, and job knowledge to be of average importance, while rating the other worker characteristics to be very important. The implications of these findings for ABE instruction are discussed in Part III of this report.

PART II

REQUIREMENTS OF THE VOCATIONAL TRAINING PROGRAM

The Courses Studied

The reading, writing, oral language, and mathematics requirements of three courses in a vocational college electrical occupation training program were studied. The courses, DC Fundamentals, Technical Mathematics, and Human Relations, were determined by the school administration and instructional staff to be representative of the electrical occupations training program as a whole. In other words, the literacy demands placed on students in other electrician courses were judged to be about the same as those presented here. Courses of similar nature were part of the official training program for apprentice electricians.

Each of the courses studied combined the use of readings and lectures with practical projects designed to simulate experiences found in industry. This was true of the technical courses and the human relations course. There were many opportunities for students to relate written and spoken information to real materials and activities. Reading, writing, mathematics, and oral language skills were routinely used in classroom learning experiences in all three courses studied.

Reading Requirements

In training programs, literacy skills were used more than they were

on the job. Because they were required to learn large quantities of information during relatively short periods of time, students spent much time reading, writing and using mathematics skills. In the electrical training program, instructors estimated that students spent up to 10 hours per week on course-related reading. The combined estimated time spent on reading for all courses was seventeen hours per week. This compares to an average on-the-job reading estimate of seven hours per week. In the training program, reading was used as a learning tool most of the time. On the job, reading was used much more as a tool for doing work. Thus, regarding the use of reading, there are both quantitative and qualitative differences between training program and on-the-job settings.

The style of writing found in vocational training program reading materials was, like that found in on-the-job materials, highly technical. Excerpts from typical training program reading materials are presented in Example V.

EXAMPLE V

Training Program Reading Materials

A. Human Relations

A problem is a question raised for inquiry, consideration, and solution. Since life brings problems for all of us, effective living consists of effective problem solving. Problems are solved by that complex mechanism called the brain. (Baltus, 1976, p. 120)

B. DC Fundamentals

> It is useful to note that the entire applied voltage is present across the open circuit. Between P_1 and P_2 in Fig. 3-16b, there is 40 V. The reason is that essentially all the resistance off of the series circuit is between P_1 and P_2. Therefore, the resistance of the open circuit develops all the IR voltage drop. (Grob, 1977, p. 68)

The levels of readability or difficulty of the materials required in the training program were not as high as those found at the job sites. The effect of using lower readability materials in training programs is to enable students to acquire basic job-related knowledge without taxing their reading skills.

Table II, below, presents the levels of readability for materials used in the three electrician courses. As in Part I, estimates are reported as ranges.

TABLE II

Training Program Readability Estimates

Course One	Tenth grade to college graduate level
Course Two	College level
Course Three	Eleventh grade to college graduate level

It was noted in Part I of this report that readability formulas do not account for factors such as motivation and familiarity with the subject matter. The notion that motivation and knowledge of subject matter can reduce the perceived difficulty of reading materials is discussed in Part III, Instructional Recommendations.

Special Reading Considerations and Problems

Whereas finding information in texts, tables, figures, and charts for immediate use was the predominant reading skill applied on the job, skill in using reading as a learning tool was predominant in the electrical training program.

Reading tasks in the training program required a balance of thoroughness and the ability to identify and remember important information. Textbooks contained tables and figures similar to those found in the code books used on the job, as well as information presented in sentence/paragraph format. Typical training program reading materials are illustrated in Example VI. Tables of key information were similar to those illustrated in Examples II and VI.

EXAMPLE VI

Tabled Information

LAB 1 OHM'S LAW, COLOR CODE, USE OF OHMMETER, VOLTMETER & AMMETER

Resistor	Color Code (1)	Color Code Resistance (2)	Ohmmeter Resistance (2)	Ohm's Law: Voltage Across (3)	Ohm's Law: Current Thru (4)	Amm. Res. (6)	Calculated Resistance (5)
1.	O.W.B.	390	395	4.9	13 M.A.		377
2.	R.B.O.	20,000	19,900	14.5	.725 M.A.		20,000

Uses of Reading in the Vocational Training Program

As previously discussed, reading in the training program involved both reading to accomplish work and reading to learn. The use of reading as a learning tool involved materials similar to those illustrated in Examples I, II, III, IV, and V above. Examples II and VI illustrate tables encountered in reading-to-do tasks. Instructional recommendations

pertaining to reading to do and reading to learn are discussed in Part III.

Writing Requirements

Vocational training program writing requirements were similar to those observed at the job sites. That is, informal style was used in responding to questions in written assignments and examinations. Formal sentence structure was not typically used. Written communication was done in phrases and partial sentences which, like telegrams, concisely communicated essential information.

Wide variation of legibility was observed. Only handwriting which was too illegible to be understood was unacceptable to the instructors.

Mathematics Requirements

Each instructor who participated in the study completed a questionnaire which asked for an estimate of the importance of several mathematics skills to succeed in the electrician training program. Results of the questionnaire showed that no mathematics skills were required in the human relations course. In the technical mathematics course ability in basic trigonometry and all underlying skills were required. The electricity course required basic computational skills with whole numbers and knowledge of the decimal system, measurement, word problems, geometry and algebra. From three to seven hours per week were spent on mathematics work in the latter two courses.

Oral Language Requirements

The style of language recorded during training program lectures was typically informal. The subject matter dealt with in the lectures

was highly technical. Comprehension of lectures required some prior knowledge of the subject matter and attentive listening on the part of the students. The ability to follow verbal directions and the ability to take coherent notes was necessary, also. Likewise, students were expected to relate illustrations on chalkboards and in textbooks to the instructor's remarks during lectures and demonstrations. The excerpt in Example VII is typical of classroom language which emphasized listening ability.

EXAMPLE VII

Electrical Training Program Classroom Language

INSTRUCTOR: "Have you talked about milliamps? How many milliamps in an amp?"

STUDENT: "One thousand."

INSTRUCTOR: "A thousand? Ok. A mill is going back to being one hundredth of a cent. It's going back to like property tax. Like one tenth of a cent, there are one hundred cents in a dollar. So one tenth of one hundredth is what a thousand mills to a dollar is. It goes back to a tax rate. That's what we're talking about, or in the meter or kilogram--metric system, what is a milli? A milli is one one thousandth. What is a kilo? If you make ten K a year, ten kilobucks a year, that's ten thousand, isn't it? If you don't know those things you'll be learning them as you go through the circuits classes."

In the above example, the instructor made a clear attempt to attach the meaning of a new word "milli" to concepts and words that his students might have been familiar with. In doing so, he increased the likelihood that they would remember the word. This and other strategies for vocabulary development are discussed in the pages that follow.

PART III

INSTRUCTIONAL RECOMMENDATIONS

Project Overview

For the occupation of electrician, reading, writing, oral language, and mathematics skills required on the job and in the vocational training program were generally high.

The levels of reading skills required on the job were estimated to be in the range of college to college graduate level. In the vocational training program, the estimated readability of required materials extended from tenth grade level to college graduate level. It was noted in previous sections of this report that knowledge of key technical concepts and vocabulary, combined with the familiarity gained through daily use of required reading materials, may reduce the perceived difficulty of reading tasks.

On the job and in the vocational training program reading was used as a tool for accomplishing work and as a tool for learning. Reading-to-do work was predominant on the job where reading was used to find information and to check specifications for job tasks. Supervisors' estimates of the amount of time electricians spent on job-related reading ranged from five to ten hours per week.

In the vocational training program, reading was used more often as

a learning tool than it was on the job. However, reading-to-do tasks, requiring careful, precise attention similar to on-the-job tasks, occurred frequently. The time students spent reading for each of the three courses averaged six hours per week.

Writing requirements for both jobs and training program focused on concise communication of important information. Standard sentence structure was not used, and legibility became important only when it interfered with communication.

The level of mathematics skills required by the jobs and training courses examined in the study was, like that of reading skills, very high. Required skills ranged from basic computation through trigonometry. The amount of time spent on mathematics-related tasks on the job and in the training program was greater than the amount of time spent on reading tasks. One supervisor indicated that as many as thirty hours per week might be spent using mathematics on the job.

The oral language used on the job and in the training program required the ability to make use of oral instructions and directions given by supervisors and instructors. Supervisors felt that this ability was very important to job success. Note taking skills and the ability to relate verbal information to graphic illustrations were also necessary.

All job site supervisors, when asked to rate several worker characteristics in terms of their importance to job success, rated the following as very important: positive attitude toward work, ability to work cooperatively with others, ability to communicate through speaking, and the ability to follow oral directions. Nearly as important were good attendance and the ability to read blueprints. All of these qualities

were rated at least as high as reading or mathematics abilities. Moreover, one supervisor rated the qualities listed above as more important than job knowledge.

A brief summary of how the literacy requirements of the electrician compare to those of the other nine occupations studied is found in Appendix C.

Organization of ABE Lessons

The recommendations which follow are meant to aid teachers and tutors in designing streamlined lessons which develop literacy skills while imparting job-related knowledge. The majority of the literacy information studied in connection with the electrician occupation and training program was related to reading. Reading demands were found to be high. Even when mathematics, writing, and oral language skills were used by workers and students, they were often used in conjunction with reading. This section, by presenting background information and a method of organizing ABE lessons, emphasizes reading. The background information provided deals with the teaching of vocabulary and teaching about text structure and organization. The lesson format is based on a directed reading activity (DRA) and includes vocabulary and concept development, sentence and organizational structure, silent reading, and skill development.

The guiding principle of a DRA method of lesson organization is that words, concepts, and skills must be introduced and practiced in situations and materials that are meaningful. For example, words, sentences, tables, and illustrations should be similar to those used on the job or in the training program. It may be possible to teach

an interested ABE student the words on the Key Technical Vocabulary List in isolation, but a far better practice is to introduce and practice such words in contexts such as those found in occupational reading materials. In the case of ABE lessons, there may be a wide gap between the reading requirements of occupational materials and the reading abilities of the student. Materials which parallel those found on the job and in the training program can be developed by teachers and tutors if time permits. Through paraphrasing sections of textbooks, reference books and manuals, the readability of occupational materials can be reduced so that literacy skills and job-related knowledge can be developed simultaneously.

The value of a DRA approach is that it allows the use of any appropriate reading material in a job-related reading skill development program.

Notes on Teaching Vocabulary

The specialized vocabularies of electricians are similar regardless of the area of industry in which they work. There are many key concepts and words which are common to the electrical trade in general.

The specialized technical words of the Key Technical Vocabulary List could be taught to ABE students interested in entering the electrician field so that both the words and their meanings are recognized. This implies that the words will be taught in a meaningful, job-related context.

Two types of specialized vocabulary words occur in specialized fields such as electrical occupations. One type of word is unique to the specific field. The word "ampacity" has a very specific meaning to

trained electricians, but persons outside of the field probably have never encountered the word. In teaching words such as ampacity to ABE students, an illustration of its meaning or an example of its use would be essential.

A second type of word which needs attention in ABE lessons is one which has a common meaning in everyday communication, but which also has a specialized technical meaning. The word "current" is usually used as an adjective and suggests that something is up-to-date. In light electrical and electronics fields, however, current refers to the flow of electricity. Multiple meanings such as these should be pointed out during reading lessons. Such a practice expands students' vocabularies at a more efficient rate than when single definitions are taught.

It is important for ABE students to be introduced to common high-frequency words and technical vocabulary words via contexts which are similar to those found on the job and in the training program. As noted previously, this practice develops basic job-related knowledge and reading ability.

The following are suggestions for teaching vocabulary:

1. Whenever possible, pair the word to be taught with the concept or object to which it refers.
2. Introduce the word using an approach which focuses student attention on the word.
3. Be sure that the new word is read in context very soon after it has been taught.
4. Use the general rule that four to six new words per lesson be introduced. Learning is typically most efficient when the number of words taught is in this range.
5. Review vocabulary words frequently.

Notes on Teaching About the Structure and Organization of Text

The above suggestions on teaching vocabulary words emphasize meaning; words have little use outside of a meaningful context. Even solitary words read from a blueprint have a meaningful context to an electrician on the job.

In reading, it is important to be aware of special patterns of organization. Specialized, technical reading materials are organized differently from short stories and novels. The expository style of presenting information that is used in textbooks and other specialized or technical material is different, as several levels, from the narrative style.

At the sentence level, ABE students should be taught that expository or textbook style often relates cause and effect. Sometimes this relationship is clearly stated as in the sentence in Example X.

EXAMPLE X

Stated and Unstated Cause and Effect Relationship

A. John can do the job because he can read blueprints.

B. John can read blueprints. John can do the job.

Often, however, the relationship is not stated as in Example X-B. In such cases, readers who are not looking for cause and effect connections may miss them. In the concise, telegram-like style of writing used in many technical reading materials, important connecting words such as "because" are often omitted. Thus, readers in fields such as electrician must sometimes infer cause and effect relationships.

At the paragraph level, writers of expository material often use a format which states the main idea in the first sentnece. The last

sentence summarizes the paragraph and may tie it to the following paragraph.

At the chapter level of organization expository material provides many valuable aids to readers. Key words are used as headings to introduce important sections or concepts. Pictures, diagrams, tables, and figures are used to illustrate important ideas. Introductions and chapter summaries are likewise available as aids to readers who are prepared to use them.

ABE students should learn about style features such as these and use them to enhance comprehension. Efficient readers use knowledge of expository style to organize their reading. Awareness of the use of cause and effect keeps them alert for such relationships. Knowledge of paragraph and chapter organization is used to develop a "mind set", which helps to organize important information. Questions based on paragraph lead-sentences, headings, pictures, and other graphic aids help readers organize, comprehend, and remember what is read. A directed reading activity, described in the next section, is a system which enables the ABE student to become efficient in using organizational factors as aids to comprehension and memory.

Directed Reading Activity

This system of preparing for efficient reading may be used with individual students or with groups. In groups, it requires very little class time to prepare students for reading assignments. For both individual and group use it has been demonstrated to increase reading efficiency and comprehension.

After a review of previously taught, related concepts and assignments, follow the below procedures:

I. Develop Readiness for Reading the Assignment.

Purpose: Motivate
Set purpose for reading
Develop vocabulary

Teacher role: Ask questions--

How familiar is the subject matter and vocabulary to your student?

Teach New Vocabulary--

Be concrete: write out the words as you introduce them. Use examples, such as objects or pictures, point out word relationships; i.e., cardiograph and cardiovascular relate to cardiac--heart. Have students write the words as they are taught.

Ask Questions to Stimulate Interest--

Focus on titles, pictures, graphs. Relate an anecdote from your own experience or one your students might have had.

II. Direct the Silent Reading of the Assignment.

Develop questions from sub-headings, graphs, pictures, and tables. Try to focus on relationships in the assignment. In textbooks, useful questions are often provided by the authors.

Have pupils read silently from 5 to 20 minutes to find the answers (keeping questions in mind as they read).

Encourage students to ask for help when they are confused. Writing questions down in shorthand form is a good practice when reading is done outside of class.

III. Discuss Student Answers to Questions

Do not restate the questions unless necessary. Students need to remember the questions or they lose the purpose for reading.

Ask higher level questions to develop comprehension (have student(s) interpret, draw conclusions, and make inferences as well as recall facts).

IV. Reread as Necessary

When answers demonstrate confusion, have the student reread the appropriate small section to determine the reason for the confusion.

V. Follow-up and Skill Development

Confusion or lack of comprehension may signal a need for extra work on vocabulary, concept building, or word recognition skill.

In this phase of the lesson important mathematics and other skills can be related concretely to the reading assignment.

REMEMBER:

A DRA is a system, a routine, that you want your student(s) to learn to use independently. Remind your students of this--tell them why you use a DRA system. It will help them now and in their future study.

Reading to Accomplish Work

The term, reading to do, has been used in research and development projects done for the U.S. armed forces (Sticht, et al., 1977). Reading to do refers to the use of reading for the purpose of getting work done. It involves following written directions and reading to find information which will be used immediately. Such information need not be learned or remembered. Looking up telephone numbers; finding information in a code book; or finding important data in a table, chart, or figure are examples of reading to do. Preparation of ABE students for reading-to-do tasks can be incorporated in a directed reading activity lesson.

When lesson materials contain occupationally relevant concepts, ABE students are given important background information which will make higher level training easier. Therefore, lessons should employ materials which are similar in structure and content to those found on the job or in the vocational training program. Paragraphs, tables, charts, and

figures might be used verbatim from on-the-job or instructional materials. Alternatively, such materials might be paraphrased and reduced in difficulty to match student abilities.

Given appropriate materials and a period of orientation to them, the structural and organizational features of the table, chart, figure, paragraph, or chapter, should be emphasized (see Notes on Teaching About Structure and Organization of Text). This is essentially the first step of the DRA described above. When the materials have been introduced, the student should be directed to find a particular fact in the material. In subsequent lessons the difficulty of the information-finding task should be increased.

Skill in following written directions can be developed using a DRA system and materials similar to Example IX. Initial activities should contain only one or two steps.

EXAMPLE IX

Written Directions

1. Connect line voltage to line voltage terminals 1 and 2 (Refer to external wiring diagram).
2. Connect a jumper wire from the ground terminal post to the low probe terminal post. The level control relay should not energize.
3. Connect a jumper wire from a high ground terminal post to the high probe terminal post. The level control relay should now energize. This stimulates a full tank. (Lumenite Electronic Co., p. 2)

In information-finding lessons, the emphasis should be on the understanding and careful identification of the required fact. Likewise, in lessons on following directions, understanding and careful execution of the required steps must be emphasized.

Reading to Learn Information

Skill in learning printed information for future use is very important in vocational training programs. The reading skills necessary for reading to learn (Sticht, et al., 1977) are taught and systematically practiced in directed reading activity lessons. That is, the use of previewing, attention to graphic and contextual information, and the organizational factors discussed in Notes on Teaching About the Structure and Organization of Text, above, should be practiced and learned during each DRA lesson. Questioning and rereading, also aspects of the DRA, reinforce important learning skills.

Sources of materials for use in reading-to-learn lessons, like those employed in reading-to-do lessons, should be occupationally oriented (See Bibliography). ABE students who receive reading instruction through job-related reading materials develop not only reading skills, but gain important job knowledge as well.

Counseling the ABE Student

ABE students should be made aware of the importance of reliability, cooperation, ability to follow directions, and other factors noted in Part I of this report. On the basis of the responses of supervisors surveyed in this study and previous research (Sticht, 1975), it seems that such characteristics contribute more to job success than do reading and mathematics skills. Role-playing activities which involve consider-

ation for others and following directions may be a valuable part of ABE lessons designed to prepare adults for employment.

The literacy demands of the electrician jobs and training program courses were high. It is, therefore, important that teachers, tutors, and counselors consider the facts presented earlier in this report, the individual student's levels of motivation, and literacy skill development before beginning to prepare the student to enter an electrician job or vocational training program. Frequency and intensity of lessons, choice of instructional materials, and long-term duration of the preparatory instructional program will vary according to the student's literacy skill level, especially in reading.

This does not mean that students with low literacy skills should always be discouraged from preparing for an electrician career. It does suggest, however, that an early and realistic estimate be made of the time and effort required to reach the goal of employment or formal training.

Summary

The literacy demands of electrician jobs and training program courses were found to be high. It is probable that individual experience and familiarity with specialized information reduces somewhat the perceived demands of job and training program tasks. The extent of such a reduction, however, is not know.

It was observed that the vocational training program for electrical work provided students with experiences that were similar to on-the-job tasks. Reading materials from the training program presented important basic occupational concepts through texts which were less difficult than

materials found at the job sites. It was noted that research supports the practice of reducing readability levels when difficult concepts are presented in written form.

Instructional recommendations emphasized the development of reading skills. Other literacy and non-literacy requirements were recognized as important, but it was clear, even in cases where high level mathematics skills were necessary, that good reading skills were essential.

The recommended approach to ABE reading instruction was a directed reading activity (DRA) because it is systematic, provides for essential skill development and practice, and permits the use of any appropriate reading material. Suggestions were presented for teaching vocabulary and on the use of important structural and organizational factors which are related to reading comprehension and memory.

Two uses of reading, reading to do and reading to learn, were discussed separately because the skills they require are distinct. Reading to do requires the ability to find information for immediate use; long-term memory is not necessary. Reading to learn requires awareness of organizational factors which aid learning and remembering.

Non-literacy factors were discussed in the section, Counseling the ABE Student, because on-the-job supervisors rated several factors such as attendance and cooperativeness to be more important to job success than reading and mathematics ability, even though on-the-job literacy demands were high for electricians.

Finally, it was recommended that, in using the information and recommendations presented in the report, ABE teachers should be well acquainted with the occupational interests and motivations as well as the literacy skills of their students. Some ABE students may be unwilling or unable

to spend the time and energy necessary for success in the electrical field. Such students might choose to change their occupational goals.

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APPENDIX A

TECHNICAL VOCABULARY LIST

This list is based on the total oral and written samples of the language of electricians both on the job and in the training program. Words included in the most frequent 1000 words of the Kucera-Francis list (based on adult language) have been deleted. The list was also edited to remove numerals; labels; names of people, places, products, and companies; contractions and possessives; and colloquialisms resulting from the oral language samples.

Some words included in the list are relatively uncommon words that occurred in the total language sample and are not necessarily technical terms. Thus, the list should be treated as a source rather than a criterion. The 83 most common words have been marked with an asterisk.

Total Sample Words = 20,492

Different Words - 3,126

abilities
ebility
abnormal
absence
acceptable
acceptance
accepting
access
accessible
accident
accidents
accompanying
accomplish
accordance*
accumulating
accuracy
accurate
accurately
achieve
achieved
achievement
activated
actual
actuate
additions
adequacy
adequate
adhesive
adjacent
adjusted
adjusting
adjustment
admired
adult
adults
advanced
advice
affect
affected
affection
affects
affixed
afraid
afterward
agency
ages
aggregate
airconditioning
alarm
alarms
algebraic
allow
allowing
allows
alloys
alnico
alteration
altered
alternate
alternating
altitude
aluminum
amazed
ambient
amendatory
amp
ampacity
ampere
amperes
amplifier
amplifiers
analyze
ancient
angle
angles
animals
annunciator
anticipate
antimony
anybody
anyway
apathetic
apparatus
applieance
appliances
applicable
application
applies
apply
apprentice
approached
appropriate
approved*
approximate
architect
architects
architecture
arise
arithmetic
arm
armature
arranged
arrangement
arrow
article*
articles
asking
assembled
assemblies
assembly
assert
assistance
associate
associated
assume
assumed
atoms
attached
attachment
attaining
attempt
attendant
attitudes
attributed
authority
automated
automatic
automatically
automobile
autotransfer
avenue
avoid
aware
awful
axes

abilities
ability
abnormal
absence
acceptable
acceptance
accepting
access
accessible
accident
accidents
accompanying
accomplish
accordance*
accumulating
accuracy
accurate
accurately
achieve
achieved
achievement
activated
actual
actuate
additions
adequacy
adequate
adhesive
adjacent
adjusted
adjusting
adjustment
admired
adult
adults
advanced
advice
affect
affected
affection
affects
affixed
afraid
afterward
agency
ages
aggregate
airconditioning
alarm
alarms
algebraic
allow
allowing
allows
alloys
alnico
alteration
altered
alternate
alternating
altitude
aluminum
amazed
ambient
amendatory
amp
ampacity
ampere
amperes
amplifier
amplifiers
analyze
ancient
angle
angles
animals
annunciator
anticipate
antimony
anybody
anyway
apathetic
apparatus
applieance
appliances
applicable
application
applies
apply
apprentice
approached
appropriate
approved*
approximate
architect
architects
architecture
arise
arithmetic
arm
armature
arranged
arrangement
arrow
article*
articles
asking
assembled
assemblies
assembly
assert
assistance
associate
associated
assume
assumed
atoms
attached
attachment
attaining
attempt
attendant
attitudes
attributed
authority
automated
automatic
automatically
automobile
autotransfer
avenue
avoid
aware
awful
axes

axial	bidder	boxes*	cabinet	causes
axis	bidders	braced	cabinets	causing
bag	bidding	brain	cable*	ceiling
balance	bigger	brains	cables	ceilings
ballast	biggest	brainstorm	calculate	Celsius
ballasts	biological	brake	calculated	cemented
bands	bipolar	branch	calculation	cementing
bangs	birth	branches	calculator	centers
bar*	bismuth	break	calibrated	cents
bare	bit	breaker	calibration	chair
barns	blade	breaking	calls	chalk
barrier	blanked	breaks	canceling	chances
bars	block	bringing	canopies	changed
base	blocks	brings	capacities	changing
basements	blowing	brother	capacitive	chap
battery	bodies	built	capacitor	chapter
bear	bond	burn	careful	chapters
beating	bonded	burned	carefully	characteristic
becomes	bonding	bus	carriers	charged
begins	books	bushing	carries	charges*
behavior	boom	bushings	carry	charging
beings	boring	butterfly	carrying	chart
bell	bottle	buy	cast	chases
bench	bottom	buyer	catalog	chassis
bet	bounced	buying	catatonic	chatter
bias	bows	buzz	category	cheap
bid	box*	cab	caused	check

checked
checking
checks
chewed
choose
choosing
chosen
chromium
circuit*
circuits*
circulate
circulates
cited
claim
clamping
classed
classes
classification
classified
clean
cleaned
cleaning
cleared
climates
climb
closely
closer
closures
clothed
cobalt
code*
codes
coefficient
coil*
coiled
coils
colder
collector
collision
columns
comb
combination
combined
combustible
comfort
comfortable
commercial
commonsense
companies
comparable
compare
compared
complaining
completed
completion
complex
compliance
comply
component
components
composition
compressed
compression
compressor
computation
computed
computer
concealed
concentrate
concept
concepts
concise
concrete
condition
conditioning
conduct
conduction
conductive
conductor*
conductors*
conduit*
conduits
confidence
conflict
conform
confused
congression
connect*
connected*
connection
connects
considerable
considerate
considering
considers
consist
consistent
consisting
consists
constant
constants
constitute
construct
constructing
consumes
contact
contacts
contain
contained
container
containers
containing
contains
contentment
continuous
contract*
contractor*
contracts
contribute
controlled
controller
controls
convenient
conveyors
cooling
cools
cooperate
coordinate
coordination
cope
copper
copy
cord
cords
core*

correct
corrected
correction
correlation
correspond
corrosion
costly
counting
coupling
courses
cover
covers
crazy
crescent
crises
crisis*
crisscross
critical
cross
crowd
crowded
cruelty
crystal
cured
curie
currently
currents
curve
customer
cuts
cutting
cycle
damage
damaged
damages
dangerous
dangers
date
dates
dc
dealing
decide
deciding
decimal
deenergize
defined
defining
definition
deflection
degrees
delay
delivered
delivery
demagnetize
demand
demolition
demonstrate
denominator
density
depend
dependency
dependent
depending
depends
deposits
depth
derating
derived
description
designating
designation
desired
detail
detect
detector
deteriorate
determinant
determining
develop
developing
develops
device
devices
diagram
diagrammatic
diagrams
diapers
die
dielectric
differently
differing
dimensional
dip
directed
dirt
disagreement
disassociate
discharge
disconnect
discourage
discovered
discussed
discusses
discussing
disease
disintegrate
dislike
dislikes
disorder
display
disputable
distinct
distinguish
distorts
distributing
diversity
dives
divided
divider
dividers
divorce
documents
dodge
dollar
dollars
dominated
doors
doses
dotted
double
drag
draglines
drain
draw
drawing

drawings	economy	emphasis	escape	executive
drawn	edition	employed	essential	exhaust
dredges	effectively	empty	essentially	exhausted
dressed	effectiveness	enclosed	estimate	exist
dribble	eight	enclosure	etc.*	existing
dried	elect	enclosures	evaluates	exists
drift	electric*	encountered	evaluation	expands
drills	electrical*	energize	event	expense
drips	electrician	energized	eventually	experiencing
drives	electricity	energy	everybody	experiment
driving	electrode	engages	everyone	explain
drop	electrodes	engineering	evident	explained
dropped	electromotive	engineers	exact	explosions
drops	electron	engraved	exactly	exposed
drove	electronic	enhances	exam	expressing
drum	electrons	enter	examine	expression
drums	element	entrance	examples	expressly
dry	elevator	envelope	excavators	extended
dual	eliminate	environment	exceed	extensive
duct	eliminated	equal	exceeding	external
ducts	elsewhere	equals	exception	extra
dug	embarrassment	equation*	excess	extremes
dull	embedded	equations*	excessive	facilities
dumped	emergency	equipments	excluding	factor
dust	emf	equivalent	exclusive	failure
dynamic	emotional	erratic	excuse	false
easier	emotionally	errors	execution	familiar

families	finish	formula	gage	grass
fan	finished	forth	gallons	grease
fascinating	finishes	forty	galvanized	grids
fast	fireplace	fourth	games	grinned
fastened	fires	fraction	gases	grounded*
fault	fit	fractional	gasoline	grounding*
favor	fitting	fractions	gauge	grout
favorable	fittings	frame	gear	grow
fears	fixture*	freezing	generate	grows
feature	fixtures	frequency	generated	guarantee
fed	flammable	frequently	generating	guard
feedback	flattened	Friday	generation	guarded
feeder*	flexible*	frozen	generator	guess
feeders	floatless	frustrating	generators	guide
ferromagnet	floors	frustration	gets	guidelines
fiberglass	flow	fullscale	giving	guns
fields	flows	fully	glad	gutter
fifteen	fluids	fume	glandular	gutters
fifth	flush	functional	glass	guy
fig.	flux	functioning	goes	guys
figured	focus	functions	gold	habits
filing	follow	fundamental	govern	hallway
fill	fool	furnishes	governing	handbook
filtered	foot	furnishing	grade	handicap
financial	footing	furthermore	gradual	handle
finding	forced	fuse	graph*	handout
finds	foregoing	fuses	graphs	handy

hanger	hoists	impedance	influenced	intended
hanging	holder	impression	influences	intense
happening	holds	improper	informal	intent
happens	hole	inability	informed	interact
happiness	holes	inaccessible	initial	interaction
happy	hoods	inadequate	inoperative	interchange
hardship	hook	incessantly	input	interference
harm	hoping	inch	inquiry	interior
hated	horizontal	inches	insert	interlocks
hazardous	horsepower	incidental	inspection	internal
healthy	hostile	included	inspector	interrupting
heat	hp	includes	installation*	intersection
heater	humans	inconvenient	installed	intervals
hearing	humidity	increases	instance	interwoven
heat-reacting	humor	increasing	instances	intolerable
height	hundredth	incurred	instant	introduce
helping	hunger	independent	instinct	introduced
helps	hypotenuse	indicate	instinctive	introducing
hence	identify	indication	in truction	introduction
herein	identifying	indoor	instrument	inverted
hertz	identity	induction	insulated	investigate
high	illness	inductive	insulating	invisible
higher	illnesses	inductor	insulation	invited
highest	illustrate	inexpensive	insulator	involve
highpower	imbalance	infancy	integers	involvement
hill	immeasurable	infant	integral	involves
hock	immediately	infantile	intellectual	involving

iron*
irritability
isolated
item
items
jacket
jacketed
jerk
jerked
joint
joints
judgment
judicial
jumper*
junction
jurisdiction
keel
keen
keeping
kicked
kidding
kill
kilo
kilogram
kinds
knock
knockout
knockouts
knocks
knows
kw
lab
label
labeled
labeling
laboratories
laboratory
lag
lags
laminated
lamp
lampholder
lamps
largest
lash
lately
latest
lattice
laws
layout
layouts
lays
lcd
lead-in
leading
leads
leakage
leaking
learn
learning
leaves
legal
legislative
legislator
legs
lessen
lesser
liability
lifetime
lighting
lights
liked
likes
limitation
limiting
linear
lingering
lining
link
liquefied
liquid*
liquids
listed
listing
literal
lives
load*
loads
located
location
locations*
lock
locked
ligical
longest
looks
looped
loosely
loosen
loses
losing
loss
low
lug
lugs
machine
machined
mad
magazines
magnet
magnetic*
magnetism
magnetized
magnetizing
magnitude
mainly
maintain
maintained
maintaining
maintains
majority
manage
mandrel
manganese
manual
manufacture
mark
marked
marriage
materials*
maternal
mathematic
mature
matures
maturing

maturity
maximum
meaningful
meant
measure
measured
measurement
measures
measuring
mechanical
mechanism
median
meets
melting
memory
mental
mentally
mention
mercury
merit
message
messed
metal*
meter*
meters
mezzanine
microsecond
mil
milli
mine
minimum
minority
minute
misaligned
missed
missing
mistake
mistrust
mistuned
misunderstand
misused
mixed
mobile
moderate
moisture
molecular
molecules
moreover
motion
motivated
motivation
motives
motor*
motors
mounted
movable
ms
multimotor
multiple
multiplication
multiplied
multiply
multiplying
mutters
MV
named
nameplate
names
nationally
nearest
necessarily
necessary
negative
negligence
neoprene
net
network
neurotic
neutral
nice
nickel
nights
nine
nineteen
ninety
nobody
noisy
noncumbustable
nonhazardous
nonmagnetic
nonmetallic
normally
noted
notice
numerous
nurseries
objection
obstetrical
obtain
occupation
occupy
occur
occurs
offensive
officials
offset
ohm
ohmeter
ohms*
oil
older
opening
openings
operate
operated
operating
operations
opposite
orators
ordered
ordering
orders
ordinance
ordinarily
organic
orientation
original
oscillator
otherwise
ought
outdoor
outgrow
outlet*
outlets
outlined

outlive
output
oven
overcome
overcurrent
overhead
overlapping
overload
owner
oxygen
oz.
pace
page
pain
paint
pair
pairs
panel
panelboard
panels
papers
parallel
paralleled
paralysis
parent
parents
paresis
park
partially
pass
passing
pasted
patching
path
patient
patients
peak
pendant
penetration
perceivable
perceive
percent
perception
perceptual
perform
performs
periodic
periodical
permanent
permeability
permissible
permit
permits
permitted*
perpendicular
personality
personally
phase
phases
phelps
philosopher
physiological
pick
pictorial
pin
pipe
pipes
piping
places
plain
planned
plastic
plate
plates
platinum
played
playing
pleasant
plug
plugged
plus
pointed
polarities
polarity
pole
polynomial
popular
porches
portable
portal
portion
portions
pose
positioned
positive
possibility
post
potential
pour
poured
powerful
powers
practical
practically
practice
preapplied
precaution
preceded
preceding
precise
precision
precoated
predict
preliminary
premounted
prepaid
prepare
prepared
preschool
prescribed
presence
presented
presupposed
prevent
prevents
previous
primarily
primary
principles
printed
prints
prior
probability
probe
probes

procedure	published	rare	reconnecting	relax
proceed	pull	rat	recording	relaxation
processes	pullboxes	rated	recovered	relaxed
produce	pulse	rating*	rectangular	relay*
produced	pulses	ratings	rectified	relays
produces	pump	ratio	rectifier	release
producing	pumps	reaches	reduce	relieved
product	pure	react	reduced	relocate
profound	purple	reactance	reduction	relocation
prohibited	purposes	readings	reevaluating	remain
project	putting	reality	refer	remains
proper	quadratic	realize	referred	remarriage
properly	quantities	rearranged	refers	remedied
properties	quantity	reasonable	refrigerate	removal
protect	quarter	reasons	regard	remove
protected	questionable	receive	regardless	removed
protection	quickly	receiver	regular	rename
prove	quit	receivers	regulate	repaired
provides	quits	receptacle	regulation	repairs
provision	raceway	recessed	rejection	repeat
provisions	raceways	recessing	relate	repeated
psychological	radial	reciprocal	related	repelling
psycheses	rags	recognize	relates	repetition
psychosis	rails	recognized	relation	replace
psychosocial	raised	recognizes	relationship	replaced
psychotic	ranges	recognizing	relative	represent
publicity	rapidly	reconnected	relatively	representative

representing	resulting	rule	screen	sensitivity
represents	reunion	rules	screw	sensory
requested	reused	runs	screwed	separate
require	revenge	ruptured	screws	separated
requirement	reversal	safe	seal	separating
reserved	reverse	safety	sealed	separation
reserves	reverses	salesman	secondary	sepia
reset	rigid	salvaged	seconds	sets
residual	rise	samples	sections	setting
resist	riser	sap	secure	settle
resistance*	rocks	satisfaction	secured	settled
resistant	rolled	satisfactory	security	setup
resistor*	rolling	satisfied	seeing	seventy
resistors	roofed	satisfy	seek	severe
resolve	rooms	saturated	seeking	shafts
resolved	root	Saturday	segments	shakes
resolving	roots	scale	seldom	shaped
resonance	rotated	scaled	select	sharp
resonant	rotates	scare	selection	sheaths
resources	rotating	scared	self	shed
respective	rotation	scares	self-concept	sheet
respects	rough	scheduled	semiconductor	shipment
respond	roughing	schematics	send	shock
responds	round	schizophrenic	sending	shook
responses	routed	scientists	sends	shop
responsible	row	scratch	senses	shortcircuit
resultant	rubber	screaming	sensing	shortest

shots
shovels
shower
showing
shows
shunt
shut
shuts
shutting
sign
signal
significant
signs
silver
silverplate
silvers
similarly
simplex
simplified
simplify
simulates
simulating
simultaneous
sit
site
sitting
sixteen
sixteenth
sixteenths
sized
sizes*
sketch
sketches
sleep
slide
slight
slightly
slot
smaller
smallest
smash
smell
smoke
snap
snaps
sockets
soft
solenoid
solid
solution*
solutions
solve
solved
solving
somebody
someone
sounding
sounds
source
sources
southwest
spacers
spaces
speaking
specifically
specification*
specified*
spend
splice
splices
split
spot
square
stability
stable
stages
stainless
standards
standstill
starter
starts
stated
statements
staying
stays
steel
sticky
stimuli
stimulus
stopping
stops
storage
store
storeroom
stranded
strange
stray
strengths
stressed
strictly
strips
strongly
structural
structure
stuck
studied
studies
stuff
subjected
submit
substance
substation
substitute
subtract
subtracted
subtraction
success
successful
sufficient
suggestion
suitable
suites
sum
super
superintendent
supplement
supplied
supplies
supply
supplying
supported
supports
suppose
supposed
surge

surgical	tedious	thirteen	trapped	understood
survival	telephone	thirty	treated	underwriter
suspended	television	thoughtless	tremendous	uneven
sweating	telling	thousand*	triangle	unfinished
switch	tells	thousandth	triangles	ungrounded
switchboard	temporary	threats	trig.	uninsulate
symbol	tend	throw	triggered	unique
symmetrical	tends	thrown	trigonometry	unit
symmetry	tenth	throwover	trips	units
synonymous	term	throws	trust	unity
systematic	terminal*	thunder	tub	unknown*
tags	terminals*	till	tube	unknowns
takes	terminate	tired	tubes	unless
talked	terminated	tolerate	tubing	unnecessary
talking	terminating	tolerating	tubs	unpleasant
talks	termination	tonight	tunnel	unqualified
tall	tested	tool	tunnels	unsymmetric
taller	testing	tools	turning	unused
tank	tests	torque	twenty	unusual
tap	text	touch	twice	unwillingly
tapped	textbooks	towards	twist	upper
taps	theories	tracings	unbalance	urge
task	therein	trades	unbroken	usable
tasks	thermal	trailers	uncoated	usage
taught	thermometer	train	unconscious	useful
teams	thickness	transformed	underground	useless
technician	thirst	transistor	underneath	uses

u-shaped
usual
utility
utilization
utilize
vacation
valve
valves
vapors
variable
variables
variation
variations
variety
vary
varying
vast
ventilating
verified
verify
versus
vertical
vertically
vessels
viewed
viscous
visible
visually
volatile
volt*
voltage*
voltages*
voltmeter
voltmeters
volts*
wait
walk
walls
wants
warehouses
warm
warmth
waste
watch
watching
waterproof
watt
watts
wave
waves
waveshape
waveshapes
weak
weakly
wear
weather
wet
whenever
wherever
wherein
wider
width
winding
windings
windows
wire*
wired
wires
wiring*
wise
withdrawal
wonder
workable
workmanlike
workmen
worse
wound
wrapped
wreck
writer
yard
yours
yourself
zero
zinc

APPENDIX B

HIGHEST FREQUENCY WORD LIST

The 100 words on the following page represented 45% of all the language sampled. This list is based on the combined oral and written language samples from all occupations studied. It shows the words used most frequently by adults in the ten jobs studied and in the vocational training programs corresponding to those jobs.

Total Words	=	180,000
Total Different Words	=	9,000

the	will	your	see
of	one	was	more
to	not	get	these
and	an	has	into
a	there	must	just
is	can	any	them
in	when	he	down
it	out	got	time
for	we	know	about
that	which	then	been
you	what	don't	some
be	do	each	business
or	up	air	how
on	pressure	check	its
are	two	that's	back
I	so	but	over
this	they	system	work
with	here	through	would
as	other	valve	temperature
by	ok	going	same
if	right	well	also
have	no	use	where
all	used	than	now
at	may	it's	only
from	should	go	like

APPENDIX C

SUMMARY OF OCCUPATIONAL LITERACY REQUIREMENTS

This appendix presents a brief summary of the literacy requirements for all ten occupations studied.

SUMMARY OF OCCUPATIONAL LITERACY REQUIREMENTS

	On The Job		Training Program	
	Reading	Mathematics	Reading	Mathematics
Account Clerk	College to college graduate level	addition, subtraction, multiplication, division, decimals, fractions, business machines	11th grade to college graduate	addition, subtraction, multiplication, division, fractions, decimals. algebra
Automotive Mechanic	9th to college graduate level	basic processes, decimals, fractions, measurement	9th to college graduate level	basic processes, decimals, fractions, measurement
Draftsman	10th grade to college graduate	basic processes, through geometry, algebra, trigonometry	9th grade to college level	basic processes, through geometry, algebra, trigonometry
Electrician	college to college graduate level	basic processes, throguh geometry, algebra, trigonometry	10th grade to college graduate level	basic processes, through geometry, algebra, trigonometry
Heating and Air conditioning Mechanic	10th grade to college graduate level	basic processes, decimals, fractions, measurement, algebra	11th grade to college graduate level	basic processes, fractions, decimals, measurement
Industrial Maintenance Mechanic	10th grade to college graduate level	basic processes through trigonometry	10th grade to college graduate level	basic processes, decimals, fractions, measurement
Licensed Practical Nurse	10th grade to college level	addition, and subtraction--more necessary to dispense medication	12th grade to college graduate level	addition and subtraction
Machine Tool Operator	9th to college graduate	basic processes, decimals, measurement	9th grade to college level	basic processes, decimals, measurement
Secretary	College to college graduate level	basic processes, decimals, fractions, business machines	10th grade to college level	basic processes, decimals, business machines
Welder	few materials--reading of single word information required	basic processes, fractions, decimals, measurement	8th grade to college graduate level	basic processes, fractions, decimals, measurement, algebra