To facilitate transition and success of disadvantaged students in the regular community college vocational program, an Oregon project developed and demonstrated an integrated program of mathematical, writing, social, and vocational skills training. The project had three phases--research, implementation, and evaluation--and focused on construction training and employment. Research was done with an ERIC (Educational Resources Information Center) search, survey of construction employers in the Eugene-Springfield area, study of two Cognitive Mapping Workshops held at Mt. Hood Community College, and assessment by project staff of existing curriculum at Lane Community College. Project staff then designed an interdisciplinary curriculum that used the Construction Technology Program, a special five-credit Industrial Orientation class, and selected basic skills classes. Implementation included coordinating the Industrial Orientation class with classes in the Construction Technology Program, final selection of instructors, recruitment of students, evaluation of student skills, and an actual field test of the curriculum involving eighteen students at Lane Community College. A textbook was written for use in the field test (see Note). Evaluation focused on student evaluations of the class, student retention and employment characteristics and staff evaluation. (Appendixes include examples of class assignments, a cognitive mapping workplan, textbook section, and student evaluation form.)
PROJECT REPORT

June, 1980

This project report was prepared pursuant to Oregon State Department of Education Project in Vocational Education Request for Proposal 2-78-79 by Special Training Programs, Lane Community College.
ABSTRACT
TO BE COMPLETED BY PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR

Project Title: Skills Training for Disadvantaged Vocational Students

Project Director/Principal Investigator
Leslie Rasor, Special Training Programs
Lane Community College
Eugene, Oregon 97405

Funding Period: March, 1979 to March, 1980

NUMBER OF STUDENTS AFFECTED: 18
NUMBER OF STAFF AFFECTED: 4

OBJECTIVES:
To develop and demonstrate an effective interdisciplinary program of basic skills training for Disadvantaged vocational students.

PROCEDURES:
To develop an integrated program of mathematical, writing, social and vocational skills training based on identified needs of disadvantaged students. To field test the model curriculum with selected students.

EXPECTED CONTRIBUTION OR POTENTIAL IMPACT ON VOCATIONAL EDUCATION:
To facilitate transition and success of Disadvantaged students in the regular community college vocational program.

PRODUCT(S) TO BE DELIVERED:
Final report

FOR OREGON DEPARTMENT OF EDUCATION USE ONLY

Submitted by:

Check One:
Approved Contract . State Contract No.:
In-House . State Project No.:

Source of P.L. 94-482 Funds:
Sec. 131: $ Charged to Fiscal Year
Sec. 132: $ Charged to Fiscal Year
Sec. 133: $ Charged to Fiscal Year
Other: $ Charged to Fiscal Year

(Source) (Amount)
### Skills training for Disadvantaged Vocational Students

<table>
<thead>
<tr>
<th>Category</th>
<th>Budget 1</th>
<th>Budget 2</th>
<th>Budget 3</th>
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</thead>
<tbody>
<tr>
<td>A. Instruction</td>
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</tr>
<tr>
<td>100 Salaries</td>
<td>14,905</td>
<td>6,905</td>
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<td>200 Employee Benefits</td>
<td>3,875</td>
<td>1,705</td>
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<td>300 Travel</td>
<td>300</td>
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<td>390</td>
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<tr>
<td>Other Purchased Services</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>400 Supplies</td>
<td>3,000</td>
<td>2,000</td>
<td>1,000</td>
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<tr>
<td>Instruction Subtotal</td>
<td>22,080</td>
<td>12,080</td>
<td>10,000</td>
</tr>
<tr>
<td>B. Improvement of Instruction Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 Salaries</td>
<td>4,000</td>
<td>4,000</td>
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<tr>
<td>200 Employee Benefits</td>
<td>1,040</td>
<td>1,040</td>
<td></td>
</tr>
<tr>
<td>300 Travel</td>
<td></td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Other Purchased Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 Supplies</td>
<td></td>
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<tr>
<td>Improvement of Instructional Services Subtotal</td>
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<tr>
<td>C. Educational Media Services</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>100 Salaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 Employee Benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300 Purchased Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 Supplies</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Educational Media Services Subtotal</td>
<td></td>
<td></td>
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<td>D. Support Services Business/ Central Indirect Cost @ 43.75%</td>
<td>9,660</td>
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<td>Support Service Business and Central Subtotal</td>
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<tr>
<td>E. Other (Include explanation)</td>
<td>Other Subtotal</td>
<td></td>
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<td>Column Total</td>
<td>37,180</td>
<td>27,180</td>
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</table>
The goals of the Skills Training for Disadvantaged Students Project were:

1. To identify and document the basic skills necessary to complete a vocational training program and to obtain entry level employment.

2. To teach and reinforce the basic skills necessary for employment in a structure designed to minimize failure.

3. To provide hands-on projects which reinforce text and lecture materials, measure individual progress, and invites positive feedback for students.

4. To allow students to begin learning basic skills at their own level.

5. To expand and reinforce understanding of the world of work.

6. To facilitate student progress in the regular vocational program.

7. To document procedures used to develop and implement the project.

The project was designed in three phases: Research, Implementation, and Evaluation, and focused on Construction training and employment.

Research was done with an ERIC Search: a survey of construction employers in the Eugene-Springfield area, study at two Cognitive Mapping workshops held by Mt. Hood Community College, and assessment by project staff of existing curriculum at Lane Community College. At the conclusion of the research phase the project staff designed an interdisciplinary curriculum that used the Construction Technology Program, a special five-credit Industrial Orientation class, and
selected basic skills classes from the College's existing curriculum.

The Implementation phase included coordinating the Industrial Orientation class with classes in the Construction Technology Program, final selection of instructors, recruitment of students, evaluation of student skills, and an actual field test of the curriculum developed by the project staff. A textbook was written for use in the field test.

The Evaluation phase included student evaluations of the class, student retention and employment characteristics, and staff evaluation.

The field test involved 18 students, 11 men and 7 women, at Lane Community College during the Winter term, 1980. Four instructors, one counselor, and one administrator participated in implementing the field test.
SKILLS TRAINING FOR DISADVANTAGED STUDENTS

SECTION I - RESEARCH
### SUMMARY OF EMPLOYER SURVEY

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>EMPLOYER RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VERY IMPORTANT</td>
</tr>
<tr>
<td>1. Basic skills wanted in employee:</td>
<td></td>
</tr>
<tr>
<td>1.1 Good work habits</td>
<td>100%</td>
</tr>
<tr>
<td>1.2 Math skills</td>
<td>43%</td>
</tr>
<tr>
<td>1.3 Writing skills</td>
<td>57%</td>
</tr>
<tr>
<td>1.4 Reading skills</td>
<td>57%</td>
</tr>
<tr>
<td>1.5 Oral communication skills</td>
<td>86%</td>
</tr>
<tr>
<td>1.6 Human relation skills</td>
<td>71%</td>
</tr>
<tr>
<td>Examples of skills as described by employers:</td>
<td></td>
</tr>
<tr>
<td>1.1 Dependable, attends to instructions, honesty, consistent work habits, safety awareness and practice.</td>
<td></td>
</tr>
<tr>
<td>1.2 Basic math, ability to use square and cubic units, reading and interpreting tools, quick and accurate.</td>
<td></td>
</tr>
<tr>
<td>1.3 Time cards, daily production reports, legible writing, accuracy.</td>
<td></td>
</tr>
<tr>
<td>1.4 Written job instructions, directions to jobs, reading blueprints, safety memos, materials lists.</td>
<td></td>
</tr>
<tr>
<td>1.5 Relaying oral instructions, ability to express self (stressed several times), understand directions, understand technical terms.</td>
<td></td>
</tr>
<tr>
<td>1.6 Public relations with customers (stressed many times), getting along with supervisors and co-workers.</td>
<td></td>
</tr>
<tr>
<td>2. Qualifications required:</td>
<td></td>
</tr>
<tr>
<td>2.1 Technical training</td>
<td>57%</td>
</tr>
<tr>
<td>2.2 Previous experience</td>
<td>71%</td>
</tr>
<tr>
<td>2.3 Previous work history</td>
<td>57%</td>
</tr>
<tr>
<td>2.4 Physical ability to do the job</td>
<td>57%</td>
</tr>
<tr>
<td>3. Other skills identified by employers (rank order):</td>
<td></td>
</tr>
<tr>
<td>3.1 Ambition</td>
<td>3.6 Flexibility</td>
</tr>
<tr>
<td>3.2 Good attitude</td>
<td>3.7 Endurance</td>
</tr>
<tr>
<td>3.3 Responsibility</td>
<td>3.8 Alertness</td>
</tr>
<tr>
<td>3.4 Willing to try new job</td>
<td>3.9 Joyfulness</td>
</tr>
<tr>
<td>3.5 Willing to learn</td>
<td></td>
</tr>
<tr>
<td>4. Employee qualifications wanted by employer (forced rank choice):</td>
<td></td>
</tr>
<tr>
<td>4.1 Work attitudes</td>
<td></td>
</tr>
<tr>
<td>4.2 Work habits</td>
<td></td>
</tr>
<tr>
<td>4.3 Ability to get along with others</td>
<td></td>
</tr>
<tr>
<td>4.4 Working skills</td>
<td></td>
</tr>
<tr>
<td>4.5 Technical skills</td>
<td></td>
</tr>
<tr>
<td>4.6 Math skills</td>
<td></td>
</tr>
</tbody>
</table>

June, 1979.
Construction employers
Eugene, Springfield
Cognitive Style refers to the individual student's preferences for learning. It attends to helping the individual students understand and become responsible for their own learning. The Cognitive Style Mapping developed by M.L. Hood-Community College consists of a 28 item questionnaire and a student guide. The questionnaire helps students assess their preferences for learning by theoretical or sensory modes, social influences on their learning, cultural determinants that affect learning, and their reasoning styles.

Students who understand their own learning style have increased ability to select classes, instructors, materials and times that maximize their learning potential. Students can also develop strategies for coping effectively with classes, materials and instructors which do not fit their preferred learning style.

Cognitive Mapping can also be used to help disadvantaged students overcome their preconceptions about their learning ability. When students learn that there are many valid learning styles and that learning by reading or listening to lectures are only two of many learning styles they are better able to focus on their abilities.

Cognitive Mapping can help students recognize their skills and give them a foundation of success to build upon; with this foundation, they are then able to assess the lack of reading, writing, or math skills without self-defeating judgements of their total learning ability. Students in the field test began to see reading, for example, as "something I haven't learned very well yet," rather than "something I can't learn."

Community College Response to the High-Risk Student, American Association of Community and Junior Colleges, Wash., D.C., ERIC # ED122873 JC760255.

A Comparative Study of the Persistence and Academic Achievement of "Project 60," Middlesex Community College, Bedford, Mass, ERIC # ED100481 JC750412.

Compensatory/Developmental Programs in Texas Public Community Colleges, Texas Coll. and Univ. System, Austin, Texas, ERIC # ED110133 JC50440.


Creativity Training--A Tool for Motivating Disadvantaged Students, Minnesota University, Minneapolis, Minn., ERIC # ED018210 JC680093.

A Curriculum Design for Disadvantaged Community and Junior College Students, Florida University, Gainesville, Florida, ERIC # ED015754 JC680093.


Developmental Program Primed High-Risk Students, College and University Business, July, 1971, ERIC # ED040939 HE502517.

January, 1972, ERIC # EJ48994  CO503931.

An Evaluation of Student Performance Based on Utilization of Extended Opportunity Programs and Services, Nova University, ERIC # ED103049 JC750194.

Focus on Learning, League for Innovation in the Community College, Los Angeles, California, ERIC # ED156279 JC780375.

Myth Exposed, Los Angeles County Superintendent of Schools, Los Angeles, California, ERIC # ED157570 JC780413.

Mastery Learning in the Writing Lab, ERIC # ED159686 CS204342.

Non-Traditional Student Characteristics Associated with Success in Post-Secondary Career Programs, ERIC # ED152343 JC780154.

Post-Secondary Developmental Studies Programs, State University of New York, Ithica, New York, ERIC # ED152344 JC780155.


Providing Basic Education for Manpower Program Clients, Manpower Administration, Washington, D.C., ERIC # ED12060 CE004822.

Putting the 'Teams' Spirit in Youth Training, Manpower Administration, Washington, D.C.

Results of Second Assessment Study of Developmental Education Programs, Ohio State-Wide Advisory Committee in Developmental Education, ERIC # ED157507 JC780431.

Retraining the Undeceducated Adult, California University, Berkeley, California, ERIC # ED047202 AC008925.

Self Concept Development for High Risk Students in the Community
Skills Check Series, Renton Vocational Technical Institute, Renton, Washington.

Success Breeds Success, Tarrant County Junior College District, Ft. Worth, Texas, ERIC # ED049761 JC710139.


Vocational Program for Out-of-School Youth and Adults in Building Maintenance and Commercial Cooking, Daniels Vocational Assessment and Training Center, Daniels, West Virginia, ERIC # ED158923 95 CE006487.
SKILLS TRAINING FOR DISADVANTAGED STUDENTS

SECTION II - FIELD TEST
PROJECT DESIGN  
(Winter Term, 1980)

FORMAT

Five credit, construction related Industrial Orientation class, consisting of Drafting (1 credit), Blueprint Reading (1 credit), Construction (2 credits), and Industrial Environments (1 credit). Each credit requires 12 hours of class time.

SCHEDULE

<table>
<thead>
<tr>
<th>Course</th>
<th>Time</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drafting</td>
<td>8-10 AM</td>
<td>January 8, 10, 15, 17, 22, 24</td>
</tr>
<tr>
<td>Blueprint Reading</td>
<td>8-10 AM</td>
<td>January 29, 31, February 5, 7, 12, 14</td>
</tr>
<tr>
<td>Construction</td>
<td>10-12 AM</td>
<td>January 15, 17, 22, 24, 29, 31, February 5, 7, 12, 14, 19, 21</td>
</tr>
<tr>
<td>Industrial Environments</td>
<td>10-12 AM</td>
<td>January 8, 10, February 19, 21, 26, 28</td>
</tr>
</tbody>
</table>

Schedule was established to provide time for assessment at the beginning of the Drafting and Industrial Environments modules, and exposure early in the term to actual construction experience.

INSTRUCTORS

Instructors were chosen for their expertise in their curriculum area and for their ability to focus on the needs of individual disadvantaged students.

Drafting instructor: Instructor of Drafting 1 and Industrial Orientation Drafting; drafting experience in industry.

Blueprint Reading instructor: Instructor of Blueprint Reading classes for Construction Technology Program; taught the class students missed Fall Term, able to expedite coverage of immediately necessary information.

Construction instructor: Instructor of Construction classes;
instructor for project students in their Construction Program classes (sections were arranged to keep all project students together during Winter term).

Industrial Environments instructor: Coordinator/Instruction for Industrial Orientation Program; Cognitive Style and work environment experience; counseling experience.

COORDINATION WITH CONSTRUCTION TECHNOLOGY PROGRAM

Industrial Orientation modules were scheduled for hours not filled by Construction Technology classes to insure that students could take all required classes. Regular Construction instructors were involved with the project to insure close coordination with the curriculum of the Construction Program and responsiveness to the needs of project students.

Building Construction I, a core Construction Program course, required for graduation from the Program, was waived for project students completing the 5 credit Industrial Orientation class.

Construction Program instructors were active in formulating the essential components of the construction related curriculum used in the project, in designing the Employer Survey used in the research phase of the project, and facilitating the recruiting and class scheduling during the field test of the project.

STUDENT CREDIT

The class was offered Pass/No Pass only. Credit was determined on the basis that the student has done the work (assignments repeatable until correct) or the student has chosen not to try to do the work. Students who attended class completed all assignments, some were able to complete extra work for more experience.
Curriculum Design

Four modules of Industrial Orientation were developed to coordinate with the curriculum of the Construction Technology Program. These modules were: Drafting, Blueprint Reading, Industrial Environments (one credit each), and Construction (two credits).

Each of these modules included practical, related math and reading skills exercises which were woven into the classroom and laboratory projects, rather than imposed as specific math or reading exercises. Students were shown the necessity for math, reading, and writing skills in Construction classes and jobs in class assignments, projects and on site work. All basic skills were taught in sequential steps and the job relevance was stressed. Any student having difficulty was given individual assistance until they were capable of completing the assignment. Students were also encouraged to help each other to share and reinforce skills; helping other students also enabled the students to earn positive feedback for their own abilities.

The Drafting module taught students the use of drafting equipment, drafting methodology, measurement and translation of scale, spatial relationships, precision and the necessity for accuracy in building plans, and practical mathematics and writing skills. Assignments included: writing paragraphs for lettering assignments; basic math calculations during scale and measurement practice; drafting plans for foundations, stairways, cabinets, and framing.

The Blueprint Reading Module taught students construction methodology, spatial reasoning, the language of blueprints, translation of scale, and model building from blueprints. Assignments included: calculation of floor covering material required for specific rooms, siding needed
for the exterior of a house and the drywall required to finish the
interior of the house; reading specifications from blueprints, and
translating scale to construct a model house from the blueprint.
The Construction module taught students construction terminology,
tool and equipment names and use, the use of time cards, construction
work opportunities, solar applications, materials, scheduling, and
building codes. Students worked at the construction site for practical
hands-on experience, as well as completing calculations for time cards,
payroll and tax forms.
The Industrial Environments module was designed to help students over-
come self-defeating attitudes, develop individual strategies for
success, and understand their responsibilities in the work environment.
Cognitive Mapping was used to introduce an analysis of individual
students' learning styles, strengths and weaknesses. Discussions
included the validity of diverse learning styles, strategies for
maximizing success by utilizing strengths and developing individual
strategies to improve under-developed skills. Students also learned
to relate their individual learning styles to job selection, work
style, and successfully interacting with others on the job. Students
were given individual counseling or referred to college resources for
experience or training to improve under-developed skills.
Class discussions introduced the concept of work environments as
the interaction between employer, employee, and the work to be
accomplished. The essential role of each was established before the
rules and procedures of work environments was introduced. Students
learned the basis of necessary rules and procedures rather than an
arbitrary list of rules. Assignments included developing a rationale
for hiring and firing, employee selection, and work scheduling:
group decision making; games requiring logical deduction and inference;
and outlining the effects on scheduling and one's own workload if
a co-worker is late or absent.

The instructor of the Industrial Environments module acted as a liaison
with the instructors of the other modules to maintain communication
and insure that class content was coordinated between modules. Each
instructor used examples of skills and work tasks from other modules
to insure that students understood the inter-relationship of the
content areas and to reinforce basic skills.
INSTRUCTIONAL PHILOSOPHY

The project staff developed an instructional philosophy which permeated the instruction in all modules. The initial research done for the project and the experience based expertise of the project staff was combined to formulate this instructional philosophy.

Each instructor who participated in the project, as well as many other Department instructors, completed the Cognitive Style Mapping exercises that students later used. Each instructor became familiar with the diverse cognitive styles, their own individual style, and the patterns of interaction of different styles.

Instruction in the project was designed to meet the varied learning styles of students: lectures, written materials, demonstrations, media materials, individual and group projects, and individual tutoring were included in class work where the major emphasis was on practical hands-on experience for students.

The project was designed as an inter-disciplinary class. Basic skills were incorporated by the regular vocational instructor into the content of the vocational training. Each instructor was responsible for identifying the basic skills that are necessary for their area, for maximizing student progress in the basic skills, and for helping the students identify the relevance of the basic skills to success in vocational training and on the job.

Instruction was designed to meet student needs, rather than instructor needs. Teaching was done in small steps that lead students through the process. Instructors tried not to assume that students would fill in the gaps that instructors, with their subject familiarity, often
leave in the sequence of conveying information to students; instead, 
instructors tried to show how each step leads to the next, and to 
show how each part relates to the total concept. Abstract principles 
were related by concrete examples. New material was related to the 
knowledge students had previously learned. Sequential instruction 
was used to demonstrate how learning is often transferable to facilitate 
comprehension of new material.

In order to maximize the success of the students’ experience the class 
work was evaluated in three modes: can do, cannot yet do, and has not 
tried. This no-fail format has been successful with Industrial 
Orientation students in previous years: without the fear of failing 
on the first try, students are willing to risk learning.

The class was organized with a few clear but firm rules in order to 
provide clear understanding of expectations and to promote self- 
discipline for students. The rules for the class were:

1. Attend class
2. Be on time
3. Listen and follow directions.
4. Ask questions (Take an active role in your learning.)
5. Participate in class activities and complete assignments.
6. Be positive
STUDENT RECRUITMENT AND ASSESSMENT.

Recruiting students was the most significant problem encountered during the project. The project staff determined that it would be essential that the class not be perceived by students as a "dummy's class"; the staff did not wish to add any stigma for students with disadvantaged academic histories. The class was not titled "Disadvantaged" or presented to students as a disadvantaged class, but was called Industrial Orientation for Construction Technology. In attempting to avoid the stigma for students enrolling in the class, the project staff made it difficult to enroll an adequate number of students when the class was first offered. It was necessary to revise our recruiting technique, causing the field test to be delayed for one term.

Initially, we used the counselor for the Construction Technology Program and the required Construction Technology Program meeting (held prior to registration) to inform students about the Industrial Orientation class. Many students were interested but did not wish to add five credits to the already substantial course load required for the program. With less than fifteen students enrolled in Industrial Orientation, the project staff decided to postpone the field test and revise the recruiting methods.

The following term the field test was put into operation. This time the students were informed, at the pre-registration meeting required for all new students, that Industrial Orientation was designed to make new students more successful in their Construction Technology classes, and was required for all new students. The students were also told
that they had missed the first term (Fall Term) of a sequential
program and the Program was providing them an abstract of the first
term's work. This meets the concerns of many students who were
apprehensive about entering the Program late; offering the class
Winter Term better met students' actual needs.

The field test of the project during Winter Term enrolled 20 students;
18 students came to class, and 2 did not attend.

The first and second day of class was devoted to assessment of students' previous construction experience and basic skill levels. The project staff developed a self-assessment questionnaire; several Drafting assignments designed to assess skills in writing, reading, and comprehension of oral and written instructions; and utilized the Wide Range Achievement Test to determine math skill levels.

A profile was made for each student from test scores, subjective assessment of writing and comprehension assignments, and the students' self-assessment. The project staff determined that the student needed a minimum of 10th grade math and reading, readily understandable written work, accurate comprehension of directions, and one year construction experience to succeed in the program.

A meeting was held with each individual student to discuss the results of the student's profile. 5 students were excused from Industrial Orientation based on their profile; 4 of these students chose to take several modules of the class for additional experience. Each of the other 13 students was required to take the Industrial Orientation class and was referred to additional resources (Math I, Study Skills, GED classes) where appropriate. Many of the students with low skill levels were eager to improve their skills and enrolled in classes which
met their needs. Two students maintained less enthusiastic attitudes and required frequent feedback and counsel to complete their required coursework during the term.

The instructor of the Industrial Environments module was responsible for meeting with each student to discuss the assessment profiles. During this initial meeting, each student was encouraged to come to the instructor for whatever assistance the student might need during and after Winter term. The instructor also was able to help the students incorporate their assessment profile with their Cognitive Style Map during the Industrial Environments module, and to help students with their assignments in other modules. This required, however, that instructor's attendance and participation in all of the other modules. This instructor was the primary contact for students, gave the class a continuity it might not have had with four instructors, and was responsible for early identification and resolution of student problems.
CONCLUSIONS AND SUMMARY

It became apparent during the project that the most critical element was the commitment of time and effort by the project staff. One person can prepare and summarize the research, but all staff members must be involved in the design, scheduling, and implementation of the project; without staff involvement there can be interruptions in the continuity of the curriculum, diffusion of instructional philosophy, and difficulties with scheduling of materials and activities.

The staff also determined that written instructional materials were essential for student learning. To insure that the materials used for the project class were specifically targeted to the curriculum designed for this class and to the skill level of the students, a textbook was written for the class. This also minimized the expense for students by requiring them to purchase only one book instead of a standard text for each module. If time and funding had allowed, we could have improved the accessibility to instructional materials for students with vision impairment, dyslexia, or severe deficiencies in reading skills by making audio tapes of the text where possible.

The field test reaffirmed our decision to prevent the class from garnering the stigma of Disadvantaged, remedial or "the dummies class." The class earned the reputation with students as a helpful addition to the Construction Program. Several students who were excused from the class, after assessment determined that they were not disadvantaged, chose to attend class; other students who entered the Program during earlier terms expressed regret that it had not been offered for them.

Evaluations by students, staff, and the Program administrator have
prompted serious consideration of scheduling Industrial Orientation for Construction Technology students again during Winter Term, 1981.

In summary, the Industrial Orientation class designed for this project is an interdisciplinary combination of basic skills, vocational skills, and work environment skills. The interdisciplinary focus requires the coordinated efforts of all instructional staff to insure continuity and clarity for students, and to alleviate scheduling difficulties.

The instructional philosophy of the class gives priority to student needs, acknowledges the diversity of learning styles, devotes attention to maximizing students' strengths while improving under-developed skills, and encourages individual responsibility for students.

The curriculum content of each module teaches basic skills as vocationally related assignments while teaching students basic vocational skills in Drafting, Blueprint Reading, Construction, and Industrial Environments.

The class is designed to provide a no-fail environment with maximum positive feedback for students.

Because the class was in modular form with four instructors, it was necessary to have a primary instructor who was responsible for coordinating the class. This instructor was also the person who was responsible for appraising student progress, problem resolution, and maintaining student contact.

Adaptation of this class to other vocational programs would require:

1. Identification of basic vocational skills necessary for success in the regular program. For example: a welding program might require blueprint reading, basic metallurgy, and introductory arc and gas welding theory and practice.
2. Assessment of the basic skills necessary for success in the vocational program.
3. Incorporation of basic skills training into the vocational curriculum.
4. Staff training to develop expertise in Cognitive Style Mapping and understanding of the effect of differences in learning styles on student progress.
5. Developing written materials and assignments that meet the instructional goals of the class.
6. Staff commitment and coordinated efforts.

The Project Director will provide assistance in developing a similar class at other institutions if requested. Copies of the textbook are available for the cost of printing from:

Special Training Programs
Lane Community College
4000 East 30th Avenue
Eugene, Oregon 97405
PROJECT FOLLOW-UP

The Construction Technology Program at Lane Community College is positively considering scheduling Industrial Orientation for Construction students' Winter Term, 1980.

The textbook written for the class has been used as a resource by the Pre-apprenticeship Program at the College as they develop a curriculum and materials specific to their needs.

The class has also gained the attention of a group of employers who are interested in scheduling a Shop Fabrication class to train employees. If this class is scheduled, an Industrial Orientation that includes Welding, Blueprint Reading, Machine Shop and Industrial Environments may be used to provide students with good basic skills before vocational training for Shop Fabrication is begun.

Much of the design and implementation of Industrial Orientation for Construction Technology has been incorporated into the regular Industrial Orientation Program modules. The regular Program continues to provide career exploration and exposure to the technical/industrial trades for women and men, but increased attention to providing substantial skills training has been incorporated into the Program design.
SKILLS TRAINING FOR DISADVANTAGED STUDENTS

SECTION III - EVALUATION
PROJECT EVALUATION

This evaluation, written by a third party, is based on the material requested for the final report. Consequently, the program has been evaluated based on program goals, a summation of the significance of project outcomes resolving the needs of Disadvantaged students, reducing sex bias and stereotyping, and improving teaching techniques.

EVALUATION OF PROJECT GOALS

Goal 1. To identify and document the basic skills necessary to complete a vocational training program and to obtain entry level employment.

Both the employer skill survey and the discussion with the Construction Technology staff identified the basic skills required to succeed in a vocational training program and to meet employer requirements for employment. This design methodology is an effective functional approach in program research and design.

Goal 2. To teach and reinforce the basic skills necessary for employment in a structure designed to minimize failure.

To minimize failure, a Pass/No Pass grading system was employed, instructors focused on the students' strengths and provided extensive positive motivation and feedback. The positive approach to students appears to be an effective means of teaching and reinforcing basic skills.

Goal 3. To provide hands-on projects which reinforce text and lecture materials, measure individual progress, and invites positive feedback for students.

This goal was achieved by designing hands-on projects that
incorporated basic skills. The thrust of the program tied positive feedback to the student for his or her achievement in class assignments and hands-on projects. The use of basic skills and hands-on projects combined with positive reinforcement was an effective means of achieving this goal.

Goal 4. To allow students to begin learning basic skills at their own level.

The use of assessment testing and individual conferences were used to determine basic skill requirements. Some students were assigned to the regular program because of this testing. Other students were counseled into various basic skills classes in addition to the regular program. This process to develop individual strategies for skill improvement was an effective means of achieving individually tailored basic skill learning that neither required the student to repeat unnecessary classes nor miss essential learning experiences. It also utilized existing College resources as well as the project experience.

Goal 5. To expand and reinforce understanding of the world of work.

The use of the Industrial Environments module and reinforcement by vocational instructors provided an overview of the requirements of the world of work. The goal, through these two educational approaches was adequately reached. The closure of the College, because of ice and snow, for two days during the Industrial Environments module prevented full implementation of the work environments curriculum; this makes it difficult to evaluate the implementation and impact of the total curriculum.
Goal 6. To facilitate student progress in the regular vocational program.

The use of the modules in Drafting, Blueprint Reading, and Construction facilitated rapid acquisition of the skills necessary to succeed in the regular Construction program. In addition, the fact that the students were identified as Disadvantaged made instructors more aware of their individual differences and needs. Also, the availability of the Industrial Environments instructor for individual assistance and counsel with students provided support and problem resolution for students.

Goal 7. To document procedures used to develop and implement the project.

This report, as an entity, documents the procedures used to develop and implement the project.

The Skills Training Program for Disadvantaged Vocational Students clearly demonstrated that positive instruction and reinforcement of student strengths results in increased learning and skill building. Perhaps the most significant result in this project was the high degree of success these students had in their regular Construction Technology classes. Clearly, the early identification, low student to teacher ratio, positive instruction and reinforcement, and relevant hands-on instruction greatly enhanced the potential for success. The attached student follow-up demonstrates this observation.

The project demonstrates that regular vocational programs can be improved by developing introductory and/or basic skills that insure increased awareness and appropriate attention for Disadvantaged students.
Conversely, placement of Disadvantaged students in a regular vocational program without adequate instructional support increases the potential for the failure of those students.

The regular Industrial Orientation Program was designed, in its original format, as a non-traditional educational exploration for women and men. The College's design of this project to meet the needs of students in the Construction Technology Program again demonstrates that both women and men needing basic skills training can succeed in regular vocational programs.

The Industrial Orientation textbook has made a significant contribution to non-traditional and Disadvantaged industrial training programs. Minor revisions to this textbook can result in important educational applications for a variety of introductory industrial programs. The textbook has been disseminated upon request throughout the United States.
STUDENT EVALUATION SUMMARY

Students evaluated each module of Industrial Orientation for Construction Technology using the form included in the Appendix. The average student rating for each module (scale: 1, not worth my time, to 10, worth my time, good) was:

<table>
<thead>
<tr>
<th>MODULE</th>
<th>RATING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAFTING</td>
<td>8</td>
<td>Excellent teacher</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liked learning why</td>
</tr>
<tr>
<td></td>
<td></td>
<td>accuracy is necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liked learning to use the tools in real projects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liked learning read skills.</td>
</tr>
<tr>
<td>BLUEPRINT READING</td>
<td>6</td>
<td>Liked learning to build.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>models.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learning symbols is boring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learning to read blueprints was useful.</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td>8</td>
<td>Visiting sites taught me a lot about construction methods.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hands-on work was best.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blueprints make more sense after we worked on the house.</td>
</tr>
<tr>
<td>INDUSTRIAL ENVIRONMENTS</td>
<td>9</td>
<td>Learning what employers expect and what I can do to get a job (was useful).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cognitive Mapping was extremely beneficial.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learning about unions and apprenticeship while we worked with journeymen.</td>
</tr>
</tbody>
</table>

Student evaluations of the benefits of the class for the individual student ranged from: "I wish other classes taught us how to do things and why we should." and "It was easy to learn here." to "I don't want to be here (in school) but I don't have anything else to do." Most students felt that the class was valuable, but wished it was longer and covered more material.
STUDENT FOLLOW-UP

The class enrolled 22 students, 15 men and 7 women. 4 of the men withdrew from school before attending any classes. The completion and follow-up statistics for the 11 men and 7 women who attended the project class are:

<table>
<thead>
<tr>
<th></th>
<th>WOMEN</th>
<th>MEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLETED INDUSTRIAL ORIENTATION</td>
<td>6*</td>
<td>10**</td>
</tr>
<tr>
<td>COMPLETED OTHER CLASSES</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>ENROLLED IN CONSTRUCTION SPRING TERM</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>ENROLLED IN OTHER VOCATIONAL PROGRAM SPRING TERM</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>ENTERED WORKFORCE SPRING TERM</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NO FOLLOW-UP INFORMATION</td>
<td>1***</td>
<td>1**</td>
</tr>
</tbody>
</table>

* The woman student who did not complete classes left school for employment.

** We have no information about the male student who did not complete classes. His parents said he has a history of disappearing for months at a time. They had not heard from him and did not know why he had left.

*** The student's training contract was terminated by the CETA program.

The project staff has maintained contact with many of the students. Some are continuing to take vocational training at the College, a few are considering relocating in search of jobs, a few are discouraged with the lack of jobs during the recession and are considering leaving the construction field.
SKILLS TRAINING FOR DISADVANTAGED STUDENTS

APPENDIX

Examples of class assignments
Cognitive Mapping Workplan
Textbook section
Student evaluation form
NOTE

STEEL
FOOTING - 3 - NO. 4
MAINTAIN 2" CONCRETE COVER
STEM - 3 - NO. 4 HORIZONTAL
- NO. 4 VERTICAL
4' 0"
PLATE, VENT, CRAWL FRAMING
STD 4' BTR, P.T. DOUGLAS FIR
2X6 (1'1/2 X 5'1/2)

Drafting Assignment
Foundation sections
Lettering and Spelling
Addition and subtraction
BLUEPRINT READING MATH ASSIGNMENTS
(EXAMPLES)

1. How much sheetrock would you need to order to finish the kitchen?*
   Sheetrock can be ordered in _____ dimensions.
   Height______
   Perimeter______
   Doors______ How many?______
   Windows______ How many?______
   Square footage = Height x Perimeter - Doors and (+) Windows
   Sheetrock needed = square footage ÷ square footage of 1 unit sheetrock.
   Draw a plan of how you would place sheetrock on the walls to minimize waste.

2. You need to order the mouldings for the doors and windows. How much moulding do you need (in linear feet)?
   Number of doors______ Moulding required______
   Number of windows (each size)______ Moulding required______
                        ______ Moulding required______
                        ______ Moulding required______
                        ______ Moulding required______
                        ______ Moulding required______
   Total______

   Remember: moulding is needed on all four dimensions of a window but only on three dimensions of a door.

3. How much laminate do you need to cover the counter tops in the kitchen?
   Kitchen (each counter)
   Length______ Width______ Backsplash______ Total______
   Length______ Width______ Backsplash______ Total______
   Total______

*Each student is provided with blueprints of a three bedroom house.
Who Would You Hire?

Directions: Decide what qualities you want an employee to have. Decide which one of the applicants to hire. Give the reasons for your decision.

You own a small construction company that you began two years ago. The business is doing fairly well, but it is still a struggle and most of your income must be put back into it. One of your employees just quit and you are very short handed. You need to hire another permanent worker to fill out your crew.

Your applicants are:

Sam, one of your current employees says his brother is looking for a job. The brother is 19, has had one year of construction classes in high school, and worked as a laborer for one summer. Sam is one of your best workers.

A man with 20 years of experience. He has never stayed with one employer for more than three months, but he knows framing, concrete finishing, roofing, painting, and dry wall taping.

A woman graduate of a two-year construction program with excellent references from her instructors and past employers. Her supervised field experience employers report said that she was an excellent worker but that she caused problems since the other employees wasted time testing the green horn.

A 40-year-old ex-minister who wants to change careers. He has had extensive woodworking experience, does fine cabinet making as a hobby. He helped to build a house 10 years ago with his father-in-law.

A man with four years framing experience. The grapevine says he comes in on weekends to steal building materials from the sites he works on, but no one has filed charges.

A black man, recently moved from the East coast, with 17 years of solid construction experience. His initial training was with the Navy Seabees.

An experienced 40-year-old man who has owned his own construction company for 15 years with 7 years of construction experience before he began his own business. Recently filed bankruptcy. His firm had a reputation for cutting corners and shoddy building practices.

A former employee you fired for not coming to work on time and for frequent absences. He did good work when he was there, but he put you in a bind many times. He says he needs a job and he learned his lesson.

1/14/80
COGNITIVE MAPPING WORKPLAN

Each of us may need to develop strategies to make the best use of our preferred learning styles and to cope with instructors or class materials that are different than our preference.

1. SPOKEN LANGUAGE
   Majors: Remember what they hear. Courses: Effective Learning, Reading.
   Minors: May need oral listening skills; ask instructors if tapes are available. Courses: Effective Learning, Listening.
   Negligibles: Need to improve listening skills. Courses: Listening; Effective Learning, Vocabulary.

2. SPOKEN NON-WORD SYMBOLS
   Majors: May need to improve vocabulary, reading. Courses: Reading, Effective Learning.
   Minors: Ask for written materials, charts, diagrams, take careful notes. Courses: Math, Effective Learning, Listening.
   Negligibles: Improve listening skills, use written materials, notes. Courses: Same as Minors.

3. WRITTEN WORDS
   Majors: May need listening skills, ask for written materials. Courses: Listening, Math.
   Minors: Strengthen reading skills. Courses: Reading Skills, Effective Learning, Use of the Library.
   Negligibles: Need to improve reading skills. Courses: Same as Minors; if skill level is low may also need Vocabulary Improvement, Read, Write and Spell.

4. VISUAL NON-WORD SYMBOLS
   Majors: Ask for charts, maps, diagrams. May need reading or listening skills.
   Minors: Need to learn to use charts, diagrams, numbers. Courses: Math, Effective Learning.
   Negligibles: Same as Minors.

5. SOUND PERCEPTION
   Majors: Distracted by sounds; need to select environment carefully. Courses: Effective Learning, Coping Skills, Assertiveness.
   Minors: May need to be more aware of sounds, particularly for job safety. Courses: Listening, Safety.
   Negligibles: Same as Minors.

6. SMELL PERCEPTION
   Majors: Distracted by odors; need to select environment carefully. Courses: Coping Skills, Assertiveness Training.
   Minors: Not aware of odors in environment; need care around machinery, i.e., "hot smell." Ask if this may cause problems on the job.
   Negligibles: Same as Minors.

7. TASTE PERCEPTION
   Majors: Chewing gum, food, coffee, cigarettes may help concentration, may need to work within class or work restrictions. Courses: Coping Skills, Effective Learning.
   Minors: May not do well as a wine taster, chef.
   Negligibles: Same as Minors.
8. TOUCH PERCEPTION
Majors: May feel stress if work area is sticky, not clean, uneven. May be sensitive to heat, pain. Consider when choosing career and job location.
Minors: May annoy others if you clutter work area. Courses: Human Relations, Interpersonal Communications.

9. SIGHT PERCEPTION
Majors: Visual distractions hinder concentration. Select work and study areas. Courses: Effective Learning, Coping Skills.
Minors: May be able to work in any environment. Courses: Physical Education.
Negligibles: Need awareness of visual clues for safety around machines. Courses: Human Relations.

10. SYNTHESIZING
Majors: Boredom with too little challenge. Select career carefully. Courses: Physical Education.
Minors: Find dexterity requirements difficult. Work on coordination. Courses: Physical Education.
Negligibles: Need methods to deal with complex physical tasks. Courses: Physical Conditioning, Effective Learning.

11. FEELINGS SENSITIVITY
Minors: May hurt other's feelings. Learn to read visual and verbal clues. Courses: Human Relations.
Negligibles: Not aware of others, difficulty getting along with others. Courses: Interpersonal Communications, Human Relations.

12. AESTHETICS
Majors: Distracted by cluttered or sterile environments. Watch environmental settings. Courses: Coping Skills, Interpersonal Communications.
Negligibles: Same as Minors, but awareness is less and problems may be more pronounced.

13. ETHICAL COMMITMENTS
Minors: Become aware of ethical issues in career choice. Courses: Human Relations.
Negligibles: May not be aware of ethics standards and obligations. Courses: Human Relations.

14. SOCIAL ROLES
Majors: Understand and can use social expectations. May be manipulative. Courses: Sales, Public Relations.
Minors: Less conforming to social roles. Courses: Job Hunting Skills, Interpersonal Communications, Human Relations.
15. **BODY/FACIAL EXPRESSION**

**Majors:** Can't talk without their hands, expressive speaker.

**Minors:** Not animated speakers, lack enthusiastic speaking abilities.

**Courses:** Speech, Interpersonal Communications.

**Negligibles:** Not animated, poor public speaking abilities. Courses: Speech Fundamentals, Human Relations, Interpersonal Communications.

16. **IMITATION**

**Major:** Doing process correctly more important than product. Not an independent learner. Courses: Effective Learning, Use of Library, Reading Skills, Math.

**Minors:** Needs less demonstrating, may be more independent learner. Product may be more important than process.

**Negligibles:** Need to learn how to use demonstrations in learning. May be too product oriented, may be nonconforming, develop skills in using demonstrations.

17. **JUDGE PHYSICAL DIFFERENCE**

**Majors:** May work better with people than things, products.

**Minors:** Difficulty with judging others need for distance. Courses: Human Relations, Interpersonal Communications, Assertiveness Training.

**Negligibles:** Difficulty in social situations, unaware of distancing factors. Courses: Human Relations, Communications Skills, Assertiveness Training.

18. **SELF-KNOWLEDGE**

**Majors:** No apparent difficulties noted. Can rely on self-knowledge of skills.

**Minors:** May overextend abilities, energy, time, may have difficulty setting limits, recognizing personal limitations. Courses: Time Management, Assertiveness Training, Human Relations.

**Negligibles:** Same as Minors. Courses recommended for Minors; may need individual counseling.

19. **IDEA COMMUNICATION**

**Majors:** Influences others.

**Minors:** Not as influential. Difficulty putting across ideas. Courses: Assertiveness Training, Interpersonal Communications, Human Relations.

**Negligibles:** Difficulty dealing with others, putting across ideas. Courses: Communication Skills, Human Relations, Interpersonal Communications.

20. **TIME ISSUE**

**Majors:** Stress over time issues. Courses: Time Management, Coping Skills.

**Minors:** Frequently late, poor sense of time. Courses: Time Management.

**Negligibles:** Always late, poor sense of time. Courses: Time Management, Counseling.

21. **PEER INFLUENCE**

**Majors:** May have difficulty with mentor system, family or individual style instructors. Courses: (Human Relations, Interpersonal Communications).

**Minors:** May experience difficulty working with peer group, co-workers. Courses: Human Relations.

**Negligibles:** Tend to isolate self from co-workers, peers. Courses: Human Relations.
22. FAMILY INFLUENCE
Majors: May have difficulty when separated from family or with peer or individual style instructors. Courses: Coping Skills, Human Relations, Interpersonal Communications.
Minors: Tend to seek out people other than family.
Negligibles: No close family influence. Counseling if this causes difficulties.

23. INDIVIDUAL INFLUENCE
Majors: Make decisions, work on individual basis. Seeks information not advice. May need awareness of support systems.
Minors: Needs others for support system. May have difficulty with peer or family style instructors.
Negligibles: May be influenced by only one group. Needs more diversification of support system. Relocation maybe a problem. Courses: Human Relations, Coping Skills.

24. RULES
Majors: Stress when rules, regulations, policies are not clear. Courses: Interpersonal Communications, Human Relations, Coping Skills.
Minors: Tend to make decisions slower than majors. Develop skill in coping with rules and policies. Courses: Human Relations.
Negligibles: Slow to make decisions, difficulty adhering to rules, policy. Courses: Human Relations, Job Skills, Counseling.

25. DIFFERENCE REASONING
Majors: May have difficulty seeing likenesses.

26. RELATIONSHIP REASONING
Majors: May have difficulty looking at ideas, relationships from whole picture. Courses: Effective Learning, Thinking Skills.
Negligibles: Difficulty understanding general rules. Courses: Thinking Skills.

27. APPRAISAL REASONING
Minors: May tend to make hasty decisions without good reasoning. Courses: Thinking Skills, Effective Learning.

28. LOGICAL REASONING
Majors: Difficulty evaluating general premises. Courses: Thinking Skills.
Minors: Do not rely on logical arguments, geometric proofs.
Negligibles: Have difficulty with logical evaluation of steps. Courses: Thinking Skills.
# ELECTRONICS

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>RELATED JOBS</td>
<td>1</td>
</tr>
<tr>
<td>THE FATAL CURRENT</td>
<td>2</td>
</tr>
<tr>
<td>FACTS ON ELECTRICAL SHOCK</td>
<td>3</td>
</tr>
<tr>
<td>ELECTRICAL SHOCK QUIZ</td>
<td>4</td>
</tr>
<tr>
<td>IDENTIFICATION OF PARTS</td>
<td>5</td>
</tr>
<tr>
<td>COMMONLY USED DATA</td>
<td>6</td>
</tr>
<tr>
<td>RESISTER CODES</td>
<td>8</td>
</tr>
<tr>
<td>WIRES AND PLUGS</td>
<td>12</td>
</tr>
<tr>
<td>FLEXIBLE CORDS AND CONDUITS</td>
<td>13</td>
</tr>
<tr>
<td>CIRCUITS AND RECEPTACLES</td>
<td>14</td>
</tr>
<tr>
<td>POWERLINE HOOKUP</td>
<td>15</td>
</tr>
<tr>
<td>GROUND FAULT CIRCUIT INTERRUPTERS</td>
<td>16</td>
</tr>
<tr>
<td>HOUSEWIRING SAMPLE</td>
<td>17</td>
</tr>
<tr>
<td>WATT USE</td>
<td>18</td>
</tr>
</tbody>
</table>
INTRODUCTION

The Electronics module will introduce the electrical concepts and terminology that are the basic foundation for both electronics and electricians occupations. Our class projects will give you practice using electronic components and equipment, making simple electrical repairs, making a circuit tester, and doing household wiring.

RELATED JOBS

APPLIANCE-REFRIGERATION TECHNICIAN
COMMUNICATIONS ENGINEERING TECHNICIANS
ELECTRONICS ASSEMBLERS
ELECTRONICS TECHNICIANS
ELECTRONICS ENGINEERING TECHNICIANS
ELECTRICAL ENGINEERS
ELECTRIC MOTOR WINDERS
ELECTRICIANS
construction
inside
maintenance
manufacturing plant
railroad
TELEVISION-CABLE LINEPERSON
UTILITY ELECTRICAL WORKER
The Fatal Current

Strange as it may seem, most fatal electric shocks happen to people who should know better. Here are some electro-medical facts that should make you think twice before taking that last chance.

It's the Current That Kills

Offhand, it would seem that a shock of 10,000 volts would be more deadly than 100 volts. But this is not so. Individuals have been electrocuted by appliances under ordinary home currents of 110 volts and by electrical apparatus in industry using as little as 42 volts direct current. The fatal measure of a shock's intensity lies in the amount of current (amperes) forced through the body, and not in the voltage. Any electrical device used on a house wiring circuit cannot be given with certain conditions, transmit a fatal current.

While any amount of current over 10 milliamps (0.01 amp) is capable of producing painful to severe shock, currents between 100 and 200 ma (0.1 to 0.2 amp) are absolutely lethal. There is no known medical procedure that will revive the victim.

Currents above 200 milliamps (0.2 amp), while producing severe burns and unconsciousness, do not usually cause death if the victim is given immediate attention. Resuscitation consisting of artificial respiration, will usually revive the victim.

From a practical viewpoint, after a person is knocked out by an electric shock it is impossible to tell how much current passed through the vital organs of his body. Artificial respiration must be applied immediately if breathing has stopped.

The Physiological Effects of Electric Shock

The chart on this page shows the physiological effects of various current densities. Note that voltage is not a consideration. Although it takes a voltage to make the current flow, the amount of shock—current will vary, depending on the body resistance between the points of contact.

As shown in the chart, shock is relatively more severe as the current rises. At values as low as 20 milliamps, breathing becomes labored, finally ceasing completely even at values below 75 milliamps.

As the current approaches 100 milliamps, ventricular fibrillation of the heart occurs—an uncoordinated twitching of the walls of the heart's ventricles. There is no worldwide help for the victim.

Above 200 milliamps, muscular contractions are so severe that the heart forcibly clamped during the shock. This clamping protects the heart from further fibrillation, and the victim's chances for survival are good.

Danger—Low Voltage

It is common knowledge that the victims of high-voltage shock usually respond to artificial resuscitation more readily than the victims of low-voltage shock. The reason may be the merciful clamping of the heart, owing to the high current densities associated with high voltages. However, lest these details be misinterpreted, the only reasonable conclusion that can be drawn is that 75 volts are just as lethal as 750 volts.

The actual resistance of the body varies depending upon the points of contact and the skin condition (moist or dry). Between the ears, for example, the internal resistance (less skin resistance) is only 100 ohms, while from hand to foot it's closer to 500 ohms. The skin resistance may vary from 1000 ohms for wet skin to over 500,000 ohms for dry skin.

When working around electrical equipment, move slowly. Make sure your feet are firmly placed for good balance. Don't lug an electric file in your pocket until it is switched off, or it will cause a shock when you reach for it. Make sure that power cannot be accidently restored. Do not work on ungrounded equipment.

Don't examine live equipment when mentally or physically fatigued. Keep your eyes focused firmly on the job, and do not allow yourself to be distracted. Wear ear protectors and eye protection when working around electrical equipment. Use only electrical equipment that has been approved by a recognized testing laboratory.

Do not work alone! Remember the more you know about electrical equipment, the more heedless you're apt to become. Don't take unnecessary risks.

What To Do for Victims

Cut voltage and/or remove victim from contact as quickly as possible—but without endangering your own safety. Use a length of dry wood, rope, mat, etc., to pry or pull the victim loose. Don't waste valuable time looking for the power switch. The resistance of the victim's contact decreases with time. The fatal 10 to 200-milliampere level may be reached if action is delayed.

If the victim is unconscious and has stopped breathing, start artificial respiration at once. Do not delay either until medical attention is reached. The victim beyond help, it may take as long as eight hours to revive the patient. The no pulse and a condition similar to rigor mortis may be present; however, these are the manifestations of shock and are not an indication that the victim has succumbed.

Reprint from SAFER OREGON

State Industrial Accident Commission
Accident Prevention Division
Special Services Section

Special Services Section
FACTS ON ELECTRICAL SHOCK

The resistance of the human body to electrical current depends on the skin condition and point of contact.*

<table>
<thead>
<tr>
<th>TYPES OF RESISTANCE</th>
<th>RESISTANCE VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry skin</td>
<td>100,000 to 600,000 Ohms</td>
</tr>
<tr>
<td>Wet skin</td>
<td>1,000 Ohms</td>
</tr>
<tr>
<td>Internal body</td>
<td></td>
</tr>
<tr>
<td>Hand to foot</td>
<td>400 to 600 Ohms</td>
</tr>
<tr>
<td>Ear to ear</td>
<td>100 Ohms</td>
</tr>
</tbody>
</table>

With 120 Volts and a skin resistance plus internal resistance totaling 1200 Ohms, there would be 1/10 amperes (100 milliamperes) of electrical current. Skin resistance gradually decreases during prolonged contact.

<table>
<thead>
<tr>
<th>SAFE CURRENT VALUES</th>
<th>1 milliamperes</th>
</tr>
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<tbody>
<tr>
<td>Causes no sensation</td>
<td>Sensation of shock but not felt, person can let go since muscle control is not lost.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNSAFE CURRENT</th>
<th>8 to 15 milliamperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painful shock, person can let go since muscle control is not lost.</td>
<td></td>
</tr>
<tr>
<td>Painful shock, muscle control lost in adjacent muscles, cannot let go.</td>
<td></td>
</tr>
<tr>
<td>Painful, severe muscle contractions, difficult breathing.</td>
<td></td>
</tr>
</tbody>
</table>

VENTRICULAR FIBRILLATION 100 to 200 milliamperes

Instant death with no known remedy.

Severe burns, severe muscle contractions that cause muscles to clamp heart and stop it during the shock.

This prevents ventricular fibrillation. *American Red Cross figures

Current is the killing factor in electrical shock. Voltage determines how much current will flow through a given resistance. Voltage as low as 25 volts can cause death; voltage over 1000 volts may not be as dangerous as a low voltage.
ELECTRICAL SHOCK

Place nearest correct answer in left margin:

1. Which one of the following is regarded as the most damaging to life?
   1. Voltage  
   2. Current  
   3. Resistance  
   4. Wattage

2. Which of the following amounts of current is the most dangerous to life.
   1. .001 Amps  
   2. .01 Amps  
   3. .15 Amps  
   4. .35 Amps  
   5. .45 Amps

3 & 4. The electrical resistance of the body depends upon 2 answers.
   1. Points of contact  
   2. Skin condition (moist or dry)  
   3. Weight  
   4. Height  
   5. Age  
   6. Health condition  
   7. Time of day  
   8. Season

5. When working around electrical equipment
   1. make sure equipment is grounded.  
   2. move slowly.  
   3. maintain good balance.  
   4. don't stand on metal or concrete floors.  
   5. None of above.  
   6. All of above.

6. A typical resistance of dry skin is about.
   1. 10 ohms  
   2. 100 ohms  
   3. 1,000 ohms  
   4. 10,000 ohms  
   5. 100,000 ohms

7. A typical resistance of wet skin is about (Use answers in Question 6.)

8. A typical resistance (internal body) from ear-to-ear is about (use answers in Question 6.)

9. One milliamper is
   1. 1/10 of an amp (.1).  
   2. 1/100 of an amp (.01).  
   3. 1/1,000 of an amp (.001).  
   4. 1/10,000 of an amp (.0001).  
   5. 1/100,000 of an amp (.00001).

10. What is the meaning of the expression "keep one hand in pocket while investigating live electrical equipment?"
IDENTIFICATION OF PARTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
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<td>5</td>
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<td>10</td>
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<tr>
<td>11</td>
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<tr>
<td>12</td>
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<tr>
<td>13</td>
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<td>14</td>
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<td>15</td>
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<td>16</td>
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<td>17</td>
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<tr>
<td>18</td>
<td></td>
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<tr>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Circuits Formulas

<table>
<thead>
<tr>
<th>Series</th>
<th>Parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resistance - Ohms</strong></td>
<td></td>
</tr>
<tr>
<td>[ R_T = \frac{1}{R_1} \cdot \frac{1}{R_2} \cdot \frac{1}{R_3} \cdot \text{ETC.} ]</td>
<td>[ R_T = \frac{R_1 \cdot R_2 \cdot R_3 \cdot \text{ETC.}}{R_1 + R_2 + R_3 + \text{ETC.}} ]</td>
</tr>
<tr>
<td><strong>Capacitance - Farads</strong></td>
<td></td>
</tr>
<tr>
<td>[ C_T = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \text{ETC.} ]</td>
<td>[ C_T = C_1 + C_2 + C_3 + \text{ETC.} ]</td>
</tr>
<tr>
<td><strong>Inductance - Henrys</strong></td>
<td></td>
</tr>
<tr>
<td>[ L_T = \frac{1}{L_1} \cdot \frac{1}{L_2} \cdot \frac{1}{L_3} \cdot \text{ETC.} ]</td>
<td>[ L_T = \frac{L_1 \cdot L_2 \cdot L_3 \cdot \text{ETC.}}{L_1 + L_2 + L_3} ]</td>
</tr>
</tbody>
</table>

### Tube Symbols

<table>
<thead>
<tr>
<th>Tube Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Diode" /></td>
<td>Diode</td>
</tr>
<tr>
<td><img src="image" alt="Triode" /></td>
<td>Triode</td>
</tr>
<tr>
<td><img src="image" alt="Tetrode" /></td>
<td>Tetrode</td>
</tr>
<tr>
<td><img src="image" alt="Pentode" /></td>
<td>Pentode</td>
</tr>
<tr>
<td><img src="image" alt="Beam Power" /></td>
<td>Beam Power</td>
</tr>
<tr>
<td><img src="image" alt="Pentagrid Convtr." /></td>
<td>Pentagrid Convtr.</td>
</tr>
</tbody>
</table>
INTEGRATED CIRCUITS

(BOTTOM VIEWS)

8-PIN
MODIFIED TO-5

10-PIN
MODIFIED TO-5

12-PIN
MODIFIED TO-5

14-PIN DUAL
INLINE

16-PIN DUAL
INLINE

BIPOLAR TRANSISTORS

P.N.P.
N.P.N.

SOLID STATE

SEMICONDUCTOR DIODE

FIELD EFFECT TRANSISTORS (FET)

N-CHANNEL P-CHANNEL
RESISTOR COLOR CODES AND USE OF THE OHMMETER

Objectives:

1. To acquire skill in identifying the value of resistors marked with the standard EIA color code.
2. To acquire skill in the use of the ohmmeter for resistance measurements.

Equipment and Supplies Needed:

An assortment of carbon resistors identified by the EIA color code.
An ohmmeter of either the Volt-Ohm-Milliammeter (VOM) or the Vacuum Tube Voltmeter (VTVM) type.

Preliminary Information:

The EIA color coding system is based on the table below which lists the ten colors used and their number equivalents. You should memorize these color-number equivalents.

<table>
<thead>
<tr>
<th>COLOR</th>
<th>SIGNIFICANT FIGURE</th>
<th>MULTIPLIER</th>
<th>TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BROWN</td>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>RED</td>
<td>2</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>ORANGE</td>
<td>3</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>YELLOW</td>
<td>4</td>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td>GREEN</td>
<td>5</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>BLUE</td>
<td>6</td>
<td>1,000,000</td>
<td></td>
</tr>
<tr>
<td>VIOLET</td>
<td>7</td>
<td>10,000,000</td>
<td></td>
</tr>
<tr>
<td>GRAY</td>
<td>8</td>
<td>100,000,000</td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>9</td>
<td>1,000,000,000</td>
<td></td>
</tr>
<tr>
<td>GOLD</td>
<td>0</td>
<td>0.1</td>
<td>5</td>
</tr>
<tr>
<td>SILVER</td>
<td>0</td>
<td>0.01</td>
<td>10</td>
</tr>
<tr>
<td>NO COLOR</td>
<td>1</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
Lab Procedure: A (Resistors)

All axial lead EIA coded resistors bear at least 3 color bands and may bear a silver or gold band indicating the "tolerance", or accuracy of the resistor. Many resistors also have a fifth band indicating that they meet certain military specifications.

The resistor should first be turned so that the end bearing the color bands is to one's left; the resistor's value in ohms is then read from left to right as follows:

The first band (nearest the end) indicates the first significant figure, the second band the second significant figure, while the third band tells how many zeros follow these two digits.

A following silver band indicates the resistor is ± 10% of the value marked; a gold band, ± 5% of the value marked; and the lack of a silver or gold band indicates a tolerance of ± 20% of the marked value. Note that the tolerance stripe does not enter into the calculation of the value of the resistor.

An example follows:

Red Violet Silver

Reading from left to right, the red band indicates the first significant number as 2; the violet band, the second significant number as 7. The orange band indicates the number of zeros that follow the first two digits, in this case, three zeros. The value of the resistor is then 27,000 ohms plus or minus 10%, the tolerance indicated by the silver band.

When resistors are less than 10 ohms, a modification of this system is used. The third band is always silver or gold. Silver indicates the first 2 digits are to be multiplied by the factor .01, gold by .1; for example, a resistor reads from left to right: brown, red, gold, silver. This indicates a value in ohms of 12 x 0.1, or 1.2 ohms ± 10%.

Wattage of a resistor is not directly related to its value in ohms but rather to the type of material it is constructed of and to its physical size which affects its ability to radiate heat.
Lab Procedure: B (Resistors)

### List the values of the following resistors:

1. Yellow-violet-black-silver
2. Blue-gray-black-gold
3. Red-red-brown-silver
4. Yellow-violet-brown
5. Brown-black-red-gold
6. Brown-gray-red
7. Red-red-red-gold
8. Yellow-yellow-orange
9. Brown-black-yellow

### Color-code the following resistors:

<table>
<thead>
<tr>
<th>Value</th>
<th>Color</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 ohms ± 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>240 ohms ± 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,700 ohms ± 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39,000 ohms ± 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120,000 ohms ± 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>240,000 ohms ± 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300,000 ohms ± 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>510,000 ohms ± 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 megohms ± 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 megohms ± 10%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lab Procedure: C (Resistors)

I. Obtain a set of 10 resistors from your instructor.

II. Measure each resistor carefully with an ohmmeter and record the color code, indicated value, and measured value in the table below.

<table>
<thead>
<tr>
<th>Color Code</th>
<th>Indicated Value</th>
<th>Measured Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
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<tr>
<td>7.</td>
<td></td>
<td></td>
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<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WIRE SIZE</td>
<td>TYPE AND USE</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Light Service</td>
<td>Used for lamps, appliances, etc. Available in light or heavy.</td>
<td></td>
</tr>
<tr>
<td>Heavy Service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Entry</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXTENSION AND APPLIANCE CORDS**
- ROMEX: Resistant to water & corrosion. Use underground, above or inside.
- ARMORED CABLE: Copper wire. Use with steel junction and switch box. Use only indoors in dry location.

**WIRE JOINING METHOD**
- **TWO-WIRE JOINING**
  - Cut insulation
  - 6 to 8 twists
  - Solder and tape

**PLUGS**
- **TWO PRONG PLUGS**
  - Cut back insulation. Cut wires in half.
  - Strip 1" insulation.
  - Twist and tape.

**SPLICING CORD WIRES**
### Flexible Cords

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPT</td>
<td>Lamp or fixture</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>HPN</td>
<td>SJT</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>HPD</td>
<td>SVT</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
</tbody>
</table>

### Conduits

<table>
<thead>
<tr>
<th>Type</th>
<th>Couplings</th>
<th>Conduits</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid steel</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>Intermediate metal</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>Thinwall metal</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>Flexible metal</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>Rigid nonmetallic</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
<tr>
<td>Surface raceway</td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
</tr>
</tbody>
</table>
### Hookup of Circuit and Receptacle

- **Fused Circuit Panel**
  - White wire
  - Ground wire
  - Black wire

- **Receptacle** (Metal box)

### Wiring Hookup for Light
- **Conduit**

### Wiring To A New Outlet
- **Conduit**
ELECTRICAL HOOKUP FROM POWERLINES

CIRCUIT BREAKER:
- 15-20 Amps. General purpose
- Two 20 Amp.
  - Kitchen
- 120-240 Volt
  - Furnace, laundry, dishwasher

METER
FROM POWERLINES
Ground fault circuit breakers have ampere ratings of 15 to 30. These devices can be installed in circuit breaker panels in order to break electrical current when a path is established between an ungrounded conductor and ground. Full circuit breaker panels with this protection are also available.

Ground fault plug-in receptacle

These devices are available for protection at the point of installation. They can be connected to other downstream receptacles to provide further protection.
HOUSEWIRING SAMPLE

ELECTRICAL SYMBOLS

- LIGHT FIXTURE
- DUPLEX RECEPTACLE
- DUPLEX WITH HALF SWITCH
- SINGLE-POLE SWITCH
- 3-WAY SWITCH
- RANGE OUTLET
- DRYER OUTLET
- SPECIAL OUTLET
- DOOR BELL
- GROUND FAULT INTERRUPTER
- SWITCH WIRING
<table>
<thead>
<tr>
<th>Appliance</th>
<th>Average Watt Use</th>
<th>Estimating Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseboard heater</td>
<td>1600</td>
<td></td>
</tr>
<tr>
<td>Blender</td>
<td>300-1000</td>
<td></td>
</tr>
<tr>
<td>Can opener</td>
<td>100-215</td>
<td></td>
</tr>
<tr>
<td>Coffee maker</td>
<td>850-1600</td>
<td></td>
</tr>
<tr>
<td>Corn popper</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>Crock pot</td>
<td>110-1600</td>
<td></td>
</tr>
<tr>
<td>Dishwasher</td>
<td>1100-1800</td>
<td></td>
</tr>
<tr>
<td>Drill, portable</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>Dryer, clothes</td>
<td>5600-9000</td>
<td></td>
</tr>
<tr>
<td>Electric blanket</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Exhaust fan</td>
<td>1'75</td>
<td></td>
</tr>
<tr>
<td>Freezer, frostless</td>
<td>050</td>
<td></td>
</tr>
<tr>
<td>Freezer, manual defrost</td>
<td>720</td>
<td></td>
</tr>
<tr>
<td>Frying pan</td>
<td>1250-1460</td>
<td></td>
</tr>
<tr>
<td>Furnace, fuel fired</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Garbage disposal</td>
<td>300-909</td>
<td></td>
</tr>
<tr>
<td>Hair dryer</td>
<td>250-1200</td>
<td></td>
</tr>
<tr>
<td>Heater, portable</td>
<td>1000-1500</td>
<td></td>
</tr>
<tr>
<td>Hot plate, two burner</td>
<td>1650</td>
<td></td>
</tr>
<tr>
<td>Light, fluorescent</td>
<td>15-75</td>
<td></td>
</tr>
<tr>
<td>Light, incandescent</td>
<td>25-200</td>
<td></td>
</tr>
<tr>
<td>Microwave oven</td>
<td>975-1575</td>
<td></td>
</tr>
<tr>
<td>Mixer</td>
<td>150-250</td>
<td></td>
</tr>
<tr>
<td>Projector</td>
<td>350-500</td>
<td></td>
</tr>
</tbody>
</table>

**ESTIMATING GUIDE**

(120/240 volt service, 100-amp minimum)

1. Number of square feet in house X 3 watts equals
2. Number of 20-amp small appliance circuits X 1500 watts equals
3. Laundry circuit equals 1500 watts
4. Appliance use
   - Water heater equals
   - Dryer equals
   - Dishwasher equals
   - Range equals
   - Shop equals
   - Other equals
   - Total equals (Add 4-9)
5. Total above equals (Add 1, 2, 3, and 10)
6. Multiply watts over 10,000 by 40% equals
7. Add heat (Number of watts equals)
8. TOTAL
9. Divide TOTAL by 240 volts to find required amps
I would rate this module as:

1 2 3 4 5 6 7 8 9 10
(not worth my time) OK (worth my time/good)

The most useful part(s) of this module were:

________________________________________________________________________

________________________________________________________________________

The least useful part(s) of this module were:

________________________________________________________________________

________________________________________________________________________

Comments and suggestions for making this module better:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Rasor

11/79